CONTEMPORARY ESSAYS IN AUSTRIAN AND HUNGARIAN GEOGRAPHY

AKADÉMIAI KIADÓ • BUDAPEST

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(Studies in Geography in Hungary 22)

Edited by
ELISABETH LICHTENBERGER
and MÁRTON PÉCSI

This volume includes the 18 papers presented at the First Austro-Hungarian Geographical Seminar, organized in Vienna, November, 1986. The Seminar was intended to demonstrate the main trends of geographical research in the two countries. Two papers focus on describing the recent trends in research in Austria (by E. Lichtenberger) and in Hungary (by M. Pécsi). The most important publications of the past two decades are also listed.

A wide range of topics is covered in the volume including the problems of geographical information systems, the applications of remote sensing in regional planning and in monitoring forest decay, the predictable ecological impacts of a barrage scheme under construction, a typology of tourism, the phenomena of second homes, rural typology in Hungary, the problems of small towns and trends of development for Alpine farms.

The Seminar helped to outline topics which can be the subjects of joint investigations in the forthcoming years.

The papers of the volume are of use not only to geographers, but also to professionals in regional planning and management.

AKADÉMIAI KIADÓ, BUDAPEST

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Geographical Research Institute
Hungarian Academy of Sciences

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Edited by
ELISABETH LICHTENBERGER
MÁRTON PÉCSI

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PREFACE

Paradoxically, the traditionally good relations between Austrian and Hungarian geographers had been limited mostly to occasional cooperation for a long time. Joint research activities were missing and no regular conferences were organized where they could have reported on their new achievements to each other. Since, however, the demand for regular professional meetings emerged from both sides, the First Austro-Hungarian Geographical Seminar was organized in Vienna in November, 1986. The present volume includes the 18 papers of this seminar.

The papers are grouped around four directions of investigation. As the Vienna conference was the first event of a new professional forum, a major aspect was the presentation of main trends in the geographical research of the two countries. It is our belief that the volume is able to indicate the diversity of topics characterizing geography in the two countries. It has been an important intention to allow the representatives of as many institutions as possible to present their latest results in order to promote the flow of information to the widest circles of the discipline. The exchange of information is served by the bibliographies containing the most important Austrian and Hungarian geographical publications.

The present volume is an important product of Austro-Hungarian geographical cooperation and, in our plans, the first step towards joint work. We mean to organise bilateral conferences at regular intervals and to find opportunities to publish the papers presented there. We are searching for topics where joint research seems feasible in order to advance geography in both countries.

Budapest, February 23rd, 1988.

Elisabeth LICHTENBERGER and Márton PÉCSI
Editors

I. GEOGRAPHICAL RESEARCH AND GEOGRAPHICAL INFORMATION SYSTEMS

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GEOGRAPHICAL RESEARCH IN AUSTRIA AT THE UNIVERSITIES AND THE COMMISSION FOR REGIONAL RESEARCH OF THE AUSTRIAN ACADEMY OF SCIENCES

by

ELISABETH LICHTENBERGER

Head of the Commission for Regional Research of the
Austrian Academy of Sciences

SUMMARY

The institutional organization of Austrian geography has expanded considerably during the past decade. The number of professors and assistants increased during the sixties and early seventies, then the number of lecturers grew considerably, thus creating a larger interdisciplinary potential. This new interdisciplinarity of geography is not least owing to the foundation of the working group "Neue Methoden in der Geographie und Raumforschung" by M. SAUBERER, who organized two successful meetings (Seekirchen, 1985; Neuberg, 1987) that might be the beginning of a new tradition of "Austrian Geographers' Meetings".

The Institute of Geography in Innsbruck was able to incorporate the Institute for Tyrolean Studies by personal union, and the Institute for Research into High Mountain Regions, too, thus broadening its scientific platform.

Geography graduates born during the baby boom of the Third Reich meanwhile have attained executive positions in the Central Statistical Office, in statistical offices of the provinces, in urban and regional planning and in the Austrian National Board for Regional Planning (ÖROK).

Urban research as well as research into population problems are highly expansive disciplines. Because of the availability of computer facilities as well as lack of chairs of demography geographers being experts in the latter field were able to gain leading positions in institutes of demography. Urban research on the other hand engaged in new scientific fields that are of central societal interest, such as the problems of the leisure society, of the segregation of guestworkers and of segments of the housing and labour markets. Both in urban research and research into problems of population there are three generations of scholars already. The latter field was initiated by H. KINZL who was followed by F. FLIRI. At present the young third generation has some connection with urban research via the social geographical approach. Urban research

originated with H. HASSINGER, the founder of the Vienna School of Urban Geography, and H. BOBEK whose successor is the present author, and there is a third generation already, too.

Progress was considerable with respect to theories and methods. With prognostication and scenario techniques, especially population and accessibility models (M. SAUBERER) ought to be mentioned. mathematical models, statistical methods and digital picture processing are being used by many geography graduates in a wide spectrum of occupations in an interdisciplinary context.

With respect to research abroad two atlases deserve special attention: The Atlas of the Tyrol, published by the Institute of Geography in Innsbruck, comprises the South Tyrol as well. An Atlas of Southeastern Europe is edited by J. BREU for the Institute of Southeast-European Studies. With these cartographic scientific documents pertaining to historical territorial units Austria substantiates her transfer role in science in Europe.

ZUSAMMENFASSUNG

Die institutionelle Organisation der österreichischen Geographie hat sich im letzten Jahrzehnt stark erweitert. Zur Vermehrung der Zahl der Professoren und Assistenten in den 60er und frühen 70er Jahren trat durch die Vermehrung der Zahl der Lektoren auch ein neues interdisziplinäres Potential. Diese interdisziplinäre Öffnung des Faches in Richtung auf die Regionalforschung ist nicht zuletzt auch der Gründung des Arbeitskreises "Neue Methoden in der Geographie und Raumforschung" durch M. SAUBERER zu danken, der zwei erfolgreiche Tagungen (Seekirchen, 1985; Neuberg, 1987) organisiert hat, die als Auftakt zu einer neuen Tradition von "Österreichischen Geographentagen" bezeichnet werden können.

Das Geographische Institut in Innsbruck konnte einerseits durch Personalunion das Institut für Landeskunde und anderseits das Institut für Hochgebirgsforschung als weitere Plattform gewinnen. Geographieabsolventen aus der Kohorte der "Kinder des 3. Reiches" haben inzwischen vielfach Führungspositionen beim Statistischen Zentralamt, den Statistischen Landesämtern, in der Stadt-und Regionalplanung sowie der Österreichischen Raumordnungskonferenz erlangt.

Stark expansive Forschungsfelder sind die Stadtforschung und die Bevölkerungsforschung. Letztere konnte dank neuer EDV-Möglichkeiten und des Fehlens von demographischen Lehrkanzeln Positionen in demographischen Instituten gewinnen. Die erstere übernahm neue wissenschaftliche Zielsetzungen, welche als gesellschaftlicher Dauerbrenner zu bezeichnen sind, wie die Probleme der Freizeitgesellschaft, die Frage der Segregation der Gastarbeiter sowie der Segmentierung des Wohnungs- und Arbeitsmarktes.

Sowohl in der Stadt- als auch in der Bevölkerungsforschung besteht bereits eine dreigliedrige Generationskette. Die Reihe der Bevölkerungsforschung führt von H. KINZL zu F. FLIRI und verbindet die junge dritte Generation über den sozialgeographischen Ansatz zum Teil mit der Stadtforschung, welche von H. HASSINGER, dem Begründer der Wiener Schule der Stadtgeographie und H. BOBEK zur Autorin und von ihr ebenfalls zur dritten Generation reicht.

In theoretisch-methodischer Hinsicht sind beachtliche Fortschritte zu verzeichnen. In der Prognose- und Szenarientechnik sind insbesonders die Bevölkerungs- und Erreichbarkeitsmodelle (M. SAUBERER) zu nennen. In der Beschäftigung mit mathematischen Modellen, statistischen Verfahren und der digitalen Bildverarbeitung haben zahreiche österreichische Geographen interdisziplinäre Positionen inne.

Unter den Leistungen der Auslandsforschung sind insbesonders die Herausgabe eines Tirolatlas, der auch Südtirol umfaßt, durch das Innsbrucker Institut sowie die Herausgabe eines Atlas für Südeuropa durch J. BREU im Institut für Südeuropa besonders hervorzuheben. In diesen an historische Territorien anschließenden wissenschaftlichen kartographischen Dokumentationen belegt der österreichische Staat seine internationale Transferrolle in der Wissenschaft in Europa.

* * *

PRELIMINARY REMARKS

The purpose of this paper is a threefold one:

1) to demonstrate the effects of the institutional organization on geographical research;
2) to set forth the main research disciplines and
3) to describe the research carried out within the framework of the Commission for Regional Research.

1. THE EFFECTS OF THE INSTITUTIONAL ORGANIZATION:

1.1. Introduction

Shadow effects are theoretical concepts well-known from regional economy, distance effect phenomena similarly from cultural disciplines.

When comparing geographical research in Austria and in Hungary with respect to these two concepts, they may serve for explaining the fact that Hungary, being a linguistically isolated area in Europe, had always been forced to make contacts with other countries and had, accordingly, communicated with the linguistic areas dominant at any given time. Whereas contacts with the German-speaking countries were a matter of course up to World War II, English has become the scholars' means of communication since.

Things are different in Austria. Because of her being part of the German-speaking area her communication pattern is unilaterally oriented towards the larger neighbour, the Federal Republic of Germany. There is no equivalent of the "Deutscher Geographentag" in Austria, and FRG journals and publications are most widely read. There is, however, some diffusion of ideas from the English-speaking countries, mainly to Vienna. Little persistence of traditional research disciplines results in a more rapid adoption of theoretical and methodological concepts of analytical geography, so that a comparison with Switzerland (ETH Zürich) seems appropriate.

The Austrian Working Group for Quantitative Geography that has been existing for more than 10 years, has an interdisciplinary spectrum of members and fulfils an important function by imparting information. Thus there is a pluralism of institutions in Austria, comprising the old-established Austrian Geographical Society - that still has many members and has formed branches in various provinces - as well as university departments, the Commission for Regional Research of the Austrian Academy of Sciences and the working group mentioned above. Besides there is practically oriented research in semi-official institutions with some affinity to geography, such as the Austrian Institute for Regional Planning, in which, just like in many government offices, geography graduates occupy leading positions.

The highly diversified scene of geographical research within government agencies and by semi-official institutions cannot be discussed here. Below the focus is, therefore, on the institutional situation of the university departments.

1.2. *The influence of social politics on the organization and goals of research in Austria and Hungary*

Official research politics and societal concepts influence both the style of research and the research goals deeply. As to these aspects Austria compares with Hungary as follows *(cf. Figure 1)*: Due to the federalistic structure in Austria there is a tendency to provide each province (Bundesland) with a university. The University Organization Act did not touch Humboldt's idea of individual scholars carrying out research independently. This concept still forms the basis for career norms and for the distribution of funds by research foundations. As before, the communication pattern rests on small groups. Geographical research is still mainly carried out within departments of geography, though there is a trend on their part to develop and maintain a high degree of individuality.

In Hungary, on the other hand, the Academy of Sciences has been awarded the leading function due to the state's centralistic organization. Government contracts regulate the distribution of financial means among the commissions and determine the research topics. In this way scientific communication is structured institutionally. Research focusses on Hungary, whereas in Austria some research in important fields is also carried out abroad.

In Austria, research grants are still awarded to individual scholars for specific projects, with research abroad having gained more importance during the past decade, not least because of remedial measures on the part of Austria for Third World countries.

1.3. *The institutional situation of the university institutes in Austria*

A few aspects should be borne in mind when considering the chances for research in a small country:

1) The small number of university institutes (6) and scientific staff of necessity brings about a certain monopolizing of specific research disciplines by certain persons. As there is little occupational mobility, moreover, a relatively marked persistence of any course adopted is to be observed.

2) There is a notable historical tendency to keep to a certain territory, i.e. a dependence of the research carried out on the physical surroundings and cultural conditions of the respective university town.

When studying the territories of the individual universities by means of the doctoral dissertations finished between 1943 and 1974, the following statements can be made with respect to the three old universities *(cf. Figure 2)*.

Vienna occupies the position of "a spider in her net" in the very centre of Lower Austria and dominates this province completely, whereas, interestingly enough, hardly any theses dealt with Vienna herself in the same period.

Fig. 1 DETERMINATION OF RESEARCH

	AUSTRIA	HUNGARY
1.	ORGANIZATION OF SCIENTIFIC WORK:	
	federalistic structure, "one university to each province", particular emphasis on independence of the institutes from each other	centralized structure, executive function of the Academy of Sciences
2.	STYLE OF RESEARCH:	
	liberalism in research, Humboldt's ideal of scholarship: research carried out independently by individuals	research largely organized by government contracts
3.	FINANCING OF RESEARCH:	
	limited means controlled by research foundations, distributed to individual scholars	distribution of public funds strictly regulated
4.	COMMUNICATION PATTERNS AMONG SCHOLARS:	
	mostly depending on personal choice, small groups	bound up with institutions
5.	RESEARCH ABROAD:	
	carried out to some extent with respect to important research sectors	lacking
6.	APPLIED RESEARCH:	
	pluralistic structure, partly "free market" with private and semi-official enterprises and institutions, research within offices of public authorities,. participation of universities	mainly carried out by institutes of the Academy of Sciences

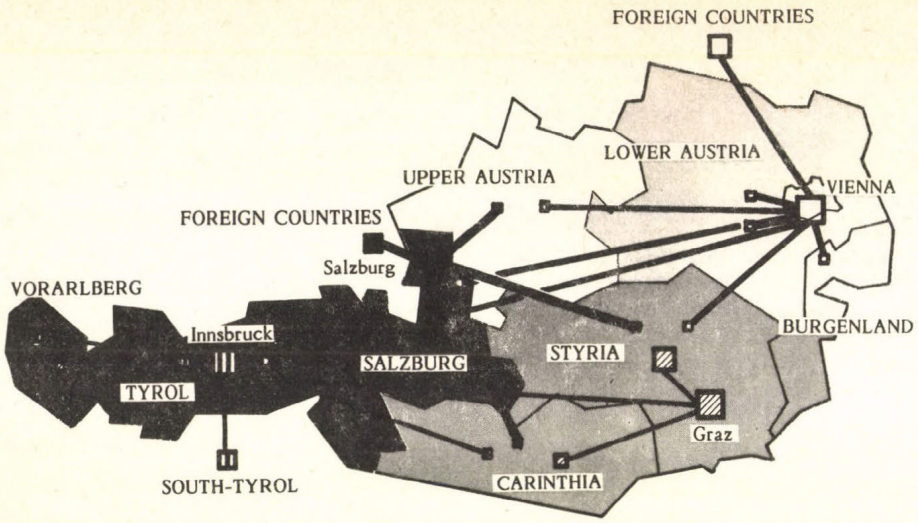

Fig. 2 Traditional territories and areas dealt with in doctoral theses of the Departments of Geography 1943-1974. Source: GJÖ 23-25 (1949-1974): List of doctoral theses of the institutes

Graz, the traditional capital of Inner Austria, dominates Styria and Carinthia. Innsbruck, with its "Alpine university", holds a special position with reference to the Alpine provinces of the Tyrol, Vorarlberg and Salzburg. Upper Austria constitutes an area in which these three universities compete with each other.

During the seventies there was a marked change as to these territories *(cf. Figure 3)*.

(1) The reorganization of the universities and the combination of the Institute for Tyrolean Studies and the Institute of Geography at Innsbruck University brought about a redirection of research towards the South Tyrol: The majority of the doctoral theses in the period studied pertain to the South Tyrol.

(2) The re-foundation of Salzburg University (1964) had its effect in including Upper Austria into its "theses' territory" at the cost of Innsbruck University.

(3) The foundation of the University for Education Sciences at Klagenfurt in 1978 cannot make itself felt yet in the period studied. Therefore the proportion of theses on Carinthia finished at the Vienna or Graz Universities during the decade studied remained the same.

(4) Graz University was able to retain its position of a true provincial university and could even consolidate it.

(5) The Vienna Institute of Geography lost some of its importance in Lower Austria, but was able to catch up with international standards in the field of theoretical and methodological problems and engaged in research abroad.

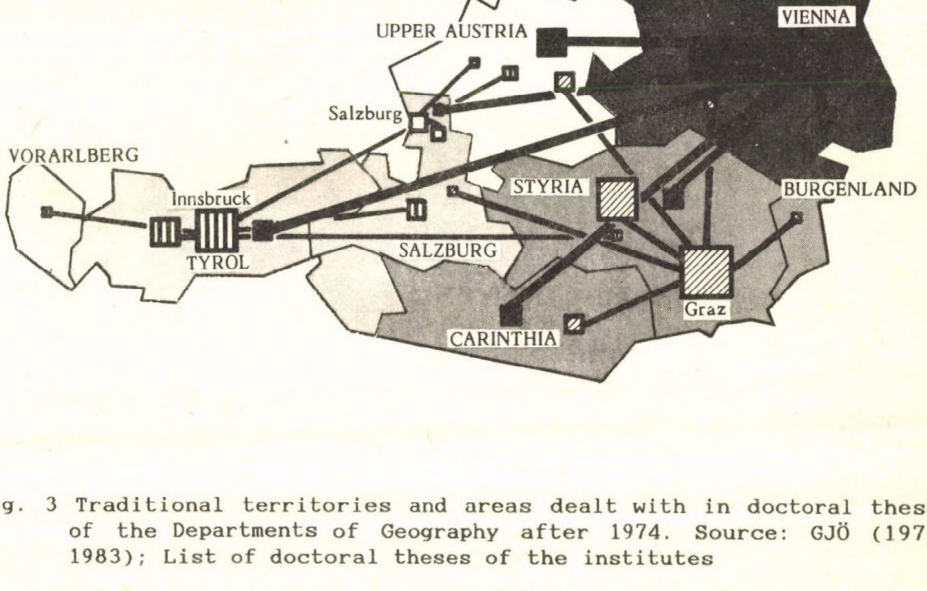

Fig. 3 Traditional territories and areas dealt with in doctoral theses of the Departments of Geography after 1974. Source: GJÖ (1975-1983); List of doctoral theses of the institutes

1.4. The effects of the University Organization Act

The seventies brought about marked changes through a reorientation of the national education politics and the passing of the University Organization Act. Education became an ubiquitous resource, the universities, as mass universities, in many cases a sort of institution for heading off redundancy. The former hierarchical structure was replaced by an egalitarian system with a parity model (professors, assistants and lecturers, and students holding one third of the seats respectively in most commissions and boards).

The effects of the University Organization Act are obvious on two levels:

(1) The increase in the number of students did not bring about the third maximum in the number of theses finished that was to be expected after those caused by the repatriation of soldiers and POW and later on by the large number of students

related to the baby boom of the late thirties and early forties. Because an intermediate degree, that of the "Magister", was introduced that satisfies the requirements for positions in the civil service reserved for graduates, masters' theses replaced the doctoral dissertations. In this way, the research potential was considerably decreased *(cf. Figure 4)*. In the long run, this Act will cause the number of dissertations to dwindle, as they are necessary only for a university career. Interestingly enough, centre-periphery effects are to be observed as to this aspect: Whereas in Vienna the students normally finish their studies with a master's thesis there is still a considerable number of dissertations prepared both in Innsbruck and Graz.

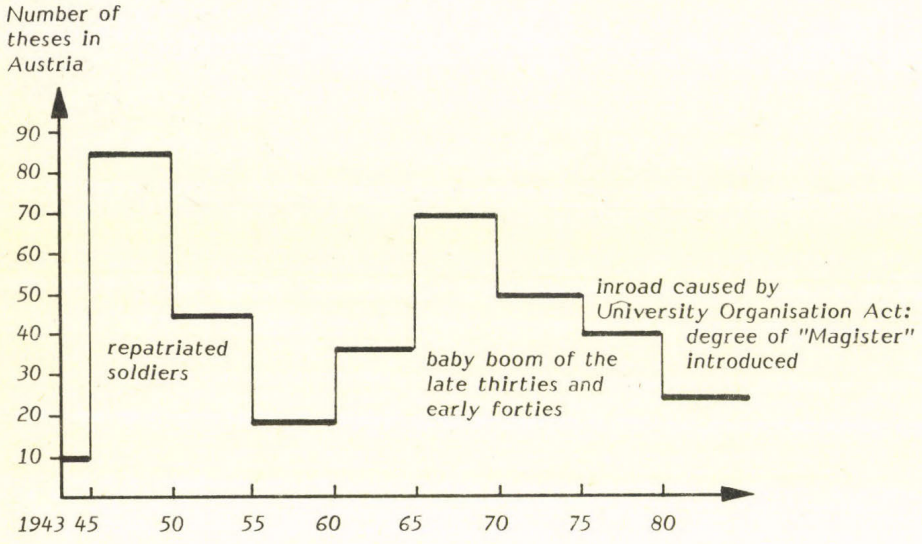

Fig. 4 Succession of cohorts and changes of amplitude in the number of doctoral theses

(2) Because of the curricula decreed it was necessary to increase the teaching staff by appointing a large number of lecturers *(cf. Figure 5)*. The number of full and associate professors as well as of assistants had grown during the sixties and early seventies, but this new development made the professors a sort of small residue. Teaching loads and administrative tasks increased, thus causing a negative correlation between the amount of research carried out and the number of teaching staff. On the whole, the stuation of research was not improved by the expansion of the universities, it deteriorated rather.

In Vienna it was, however, possible to install two new courses of study within geography, namely that of cartography and that of regional research and regional planning - and that long before the Federal Republic of Germany saw the chance of this discipline in an era in which the students planning to become grammar school teachers are faced by enormous problems when looking for jobs.

In this connection it must be pointed out that there was a much stronger tendency in Austria in the postwar period, on the part of both established professors and young graduates, to engage in a problem-oriented cooperation with neighbouring disciplines in regional planning issues.

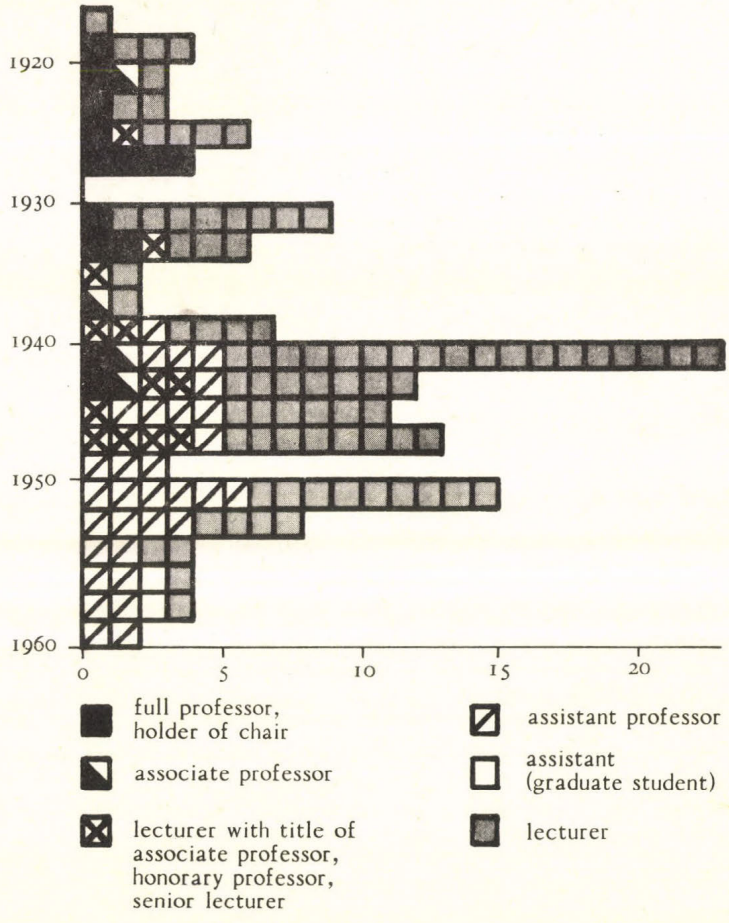

Fig. 5 The effects of the University Organization Act on the qualification structure of the teaching personnel at the universities. Source: Geographisches Taschenbuch 1985/86, eds: E. EHLERS and E. MEYNEN, Steiner-Verlag Wiesbaden, Stuttgart 1985

2. RESEARCH DISCIPLINES

A statement to begin with:

Geography came into existence as an educational discipline and became institutionalized at university for the purpose of training teachers for grammar schools. As a research discipline, geography never was a unity and never will be. This

is, however, not the place to discuss theories and methods, subject matters or scales of study for the three-dimensional information space of geographical disciplines defined in this way.

2.1. Physical Geography

A branching-off of independent subdisciplines started around 1900 with physical geography, a field with a very important tradition in Austria. When applying the standards of international and interdisciplinary achievements, three research fields ought to be mentioned:

quaternary research,
research into glaciers and
synoptic climatology.

Their importance is decisively influenced by favourable conditions with respect to specific information available:

- Quaternary research had a long tradition of meticulous recording of data in the field before the era of laboratory tests.

- Research into glaciers was assisted by a great number of volunteers who carried out measurements over a long period.

- Synoptical climatology was able to make use of the information contained in measurements made for many decades.

Actual morpho-dynamics, on the other hand, has had to cope with the drawback of not having any field-laboratories but for the Sameralm (fied-laboratory of the Institute of Geography at Salzburg University), but has succeeded in contributing interesting findings.

Let me present a few details:
Quaternary research is, on the one hand, bound up with problems of morphogenesis of the Danube and Carpathian Basins and, on the other hand, with research into the Pleistocene in the Alps. Interestingly enough, the task of a reconstruction of the recent history of the earth was able to fascinate a number of geographers in the same way as archaeologists and prehistorians are fascinated by that of human history.

J. FINK and his importance for international quaternary research and especially loess studies, not least as an organizer, can only be mentioned here. Quaternary research can make use of a large spectrum of highly specialized techniques, including dendrochronology, palynology, analysis of small mammals, palaeomagnetic measurements, C14-datings and other isotope measurements *(cf. Figure 6)*.

The key position in international research of the layered clays of Baumkirchen (F.FLIRI) in the Inn valley terrace east of Innsbruck should be pointed out, as they allowed for an absolute dating of the Würm climax, setting its duration to less than 10,000 years and dating the stages of the glaciers' retreat exactly.

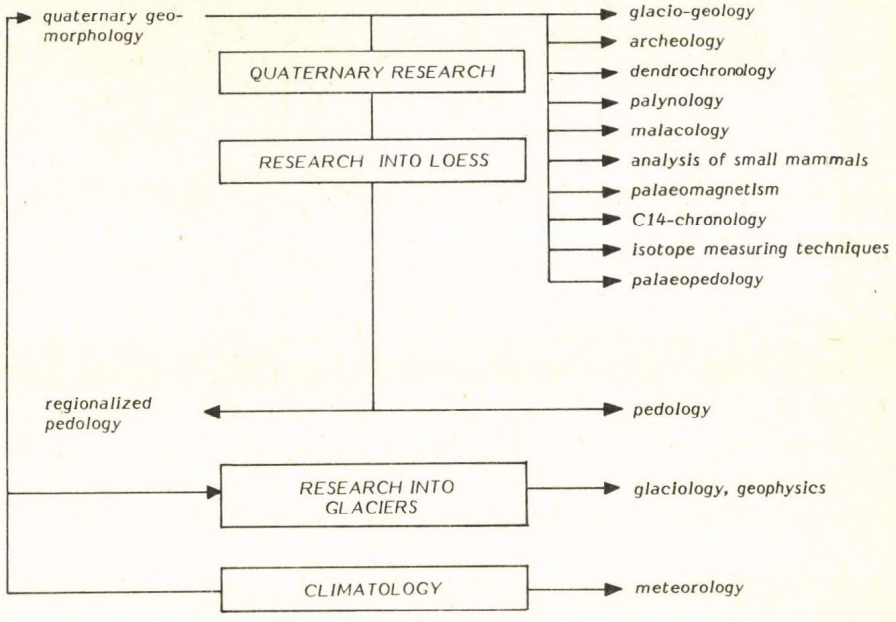

Fig. 6 The interdisciplinary branches of physical geography

Research into glaciers studies the following phenomena and processes:

(1) Mass studies, mass movements and water discharge are the traditional foci with the glaciers of the Ötztal Alps that were studied in cooperation with geophysicists and geodesists - some of them members of the Commission for Glaciology of the Bavarian Academy of Sciences. A new measurements project was started by W. SLUPETZKY on the Sonnblickkees in the Stubach valley (Salzburg).

(2) One of the bases for research into glaciers is formed by the measurements carried out in the Eastern Alps by the Alpine Club's volunteers (many of whom were geographers) ever since 1879. There is no national glacier survey so far for monitoring the development of the glaciers, though general water economy depends to a large degree on their oscillations and water discharge.

The Pasterze has been studied by the Institute of Geography at Graz University for the past 50 years, but glacier measurements on the whole are organized by the Innsbruck institute.

Within the framework of the Institute for High Alpine Research air-photogrammetic measurements of 925 glaciers were carried out by G. PATZELT in cooperation with G. GROSS and others and an Austrian Glacier Register compiled. An achieve-

ment internationally highly approved, it consists in an Austrian Glacier Data Base with about 60 variables for each glacier. It also can serve as a basis for all sorts of planning measures in the field of energy utilization and water economy. Most of the findings were published in the "Zeitschrift für Gletscherkunde und Glazialmorphologie" (editors: M. KUHN und G. PATZELT), a journal renowned worldwide.

Synoptic climatology was introduced in Austria by F. FLIRI, who, by critically studying peasants' weather maxims, entered a field of study seemingly no longer of interest to meteorologists. It entailed an enormous amount of work, as it was necessary to study the measurements taken daily in more than one thousand places over a period of 30 years. A valuable "by-product" with respect to methodology was the very first book on statistical techniques in geography in German, but the main achievements were fundamentally new findings in the field of classification systems for specific weather conditions. Moreover a new graphical way of "processing" the vast amount of data otherwise simply not graspable was developed and fully utilized. The work done by F. FLIRI and his disciples in the west of Austria is being carried on by W. WAKONIGG in the east now. Accordingly, Austria definitely is among the countries best researched with respect to synoptic regional climatology and one of the leaders in this scientific field.

2.2. Human Geography

The often cited "crisis of geography" is not a crisis of the disciplines of physical geography, but one of human geography, that is: part of a general crisis of all the social sciences in the broadest sense. Below a list of the "symptoms" is presented:

(1) There is a pluralism of philosophies of science, covering a spectrum from hermeneutics and phenomenology - that are both experiencing a sort of renascence at present - via analytic philosophy to neo-Marxism.

(2) By way of the latter two philosophies new neighbouring disciplines have established contacts with human geography, namely political science, political economy, sociology and psychology. From them, systematical theories are "imported".

(3) These neighbouring disciplines do not, as a rule, refer to the real object space and the classical scale of landscapes in their studies, but normally consider - especially so in political science and in political economy - larger spatial units. The abstract spatial concepts of economics belong to the aggregation level of countries or provinces and thus do not apply the "geographical scale proper" at an intermediate level of scale.

(4) At present there is a general trend of all of these fields to turn to ever smaller spatial units. Thus macro-economics became regional economics and sociology has developed the spatial branch of social ecology worldwide. The conclusion to

be drawn from these facts is that human geography will have to work at different levels according to the problems studied to be able to communicate with the respective neighbouring disciplines.

(5) New spatial concepts appear that are defined from the point of view of the individual, especially the action and perception spaces.

(6) Secondary data become of importance to an increasing extent. Thus, in many cases, the old tradition of primary research is abandoned, and there is an ever widening gap between primary and secondary research due to the high demand of financial resources, manpower and organization indispensible with the former. The establishment of public data banks, an increase in the number of variables in connection with censuses and provision of data on smaller spatial units easified the take-off of secondary research.

Because of problem-oriented cooperation with neighbouring disciplines and the focus on spatially relevant, action oriented perspectives research can no longer be easily classified according to strictly defined sectorial subdisciplines. Moreover, traditional spatial connexions are being destroyed in the course of the development of cities and the urban society affected by new technologies. Two spheres of research cristallize. They can be described as *"urban research"* and *"research into high mountain regions" (cf. Figure 7)*. Only in the latter, terms like "agricultural geography" and "geography of tourism" still make sense. Within urban research, on the other hand, entirely new research segments appear, such as research into the housing and labour markets to mention only two of the problem areas having been dealt with for the first time during the past decade.

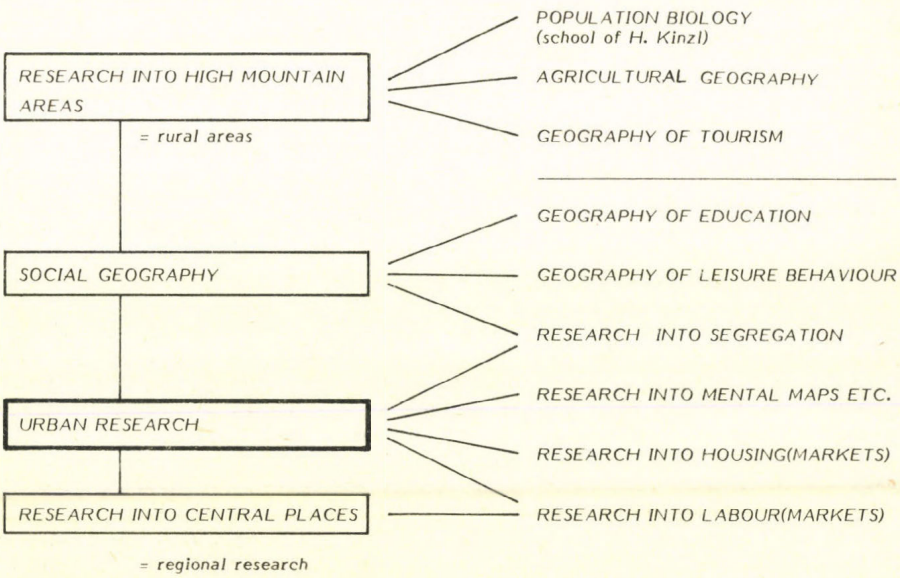

Fig. 7 Research Fields of Human Geography

Let me present a few details:
Due to the location and surroundings of the university towns, Vienna has remained the centre for urban research, whereas both in Innsbruck and Graz research into high mountain regions has always predominated. Vienna's position in urban research, incidentally, is much more prominent than might be expected with the capital of such a small country. It was established by H. HASSINGER, who had founded the Vienna School of Urban Geography as early as before World War I, in an interdisciplinary research field of urban geography, city planning, architecture and social history. This tradition was and is an obligation in two ways; firstly, the position at the research frontier is to be retained and, secondly, all of the new and scientifically relevant questions are to be tested empirically in the research area situated right at the doorstep and, thus, the political decision-makers are to be offered findings actually applicable in planning.

Urban research holds that at first the problems of the organizational structure of the urban society as to technology, politics, sociology and economy are to be dealt with. Only then the question as to their spatial distribution can be answered satisfactorily. Therefore, new fields of interest were discussed at the Berlin "Geographentag" in 1985, namely concerning effects of new communications technologies on the cities' structure and capital investment on the part of private and public decision-makers in the diverse segments of both housing and labour markets. Understandably a research discipline as expansive as this one also has a footing in research abroad, with, paralleling the spatial contacts of the country, "stepping-stones" to the Near East, from Athens via Istanbul to Tehran.

Population geography is an expansive discipline, too. The lack of chairs for demography certainly contributed to this development, therefore executive positions in the Institute for Demography of the Austrian Academy of Sciences, in the Central Statistical Office as well as in provincial administrative bodies are held by geography graduates. Demographic research is carried out on a number of levels. Thus H.KINZL's school of population biology has diversified into several areas of interest. The use of computers, the analyses of micro-censuses and the access to the data bank of the Central Statistical Office gave regional research the lead and opened the door to research abroad.

Before long population geography will extricate itself from the strictly demographic system of theories in analysing the natural reproduction of society and the migration behaviour and will adopt concepts of social geography, a field that has developed many branches in Austria in the past decade (e.g. geography of education, geography of perception and housing preferences and geography of leisure behaviour).

The geography of tourism and the leisure society has entered a problem-oriented cooperation with other scientific fields and thus increased the ratio of practical work as well as that in regional planning. There is no other geographical discipline with a similarly marked practical orientation. Geographers have a share in internal administrative basic research, e.g.

with the office of the Lower Austrian regional government, they participate, moreover, in direct contract research, in the development of tourism and regional programs, accept commissions from ministries, various boards and chambers and tourism associations. In this context it should be mentioned that the well-known experts in the field of planning for tourism, outdoor recreation and leisure-time activities of the Austrian Institute for Regional Planning are geographers.

Whereas J. MATZNETTER, formerly of Frankfurt University (FRG), has been the founder head of the IGU-Commission on Tourism, in comparison with the FRG research into tourism in foreign countries is of little importance. In connexion with mass tourism of foreign guests in Austria, geographers from the FRG have carried out numerous studies with respect to the interaction of mountain farmers and the leisure society. In western Austria, moreover, some research was made by French geographers, too.

3. *RESEARCH CARRIED OUT BY THE COMMISSION FOR REGIONAL RESEARCH OF THE AUSTRIAN ACADEMY OF SCIENCES*

A few remarks on the historical development to begin with. The Commission for Regional Research and Reconstruction was founded by H. HASSINGER in 1946. The name described the task of the Commission, namely to carry out basic research in the heavily bombed city immediately after World War II.

From 1954 to 1984 H. BOBEK was head of the Commission and prepared the National Atlas of Austria (published with the assistance of E. ARNBERGER) with a small group of only two, later on three collaborators. In retrospective, it is quite clear that such a singular achievement was only possible because of the readiness of the active generation of the reconstruction period to cooperate without any financial recompensation.

This Atlas is a document of the research status of geoscientific, cultural-historical and geographical disciplines at the time of publication, i.e. from the sixties up to well in the seventies. There are, moreover, extensive publications as to climate, vegetation, industry, transport and regional structure of the society.

Within the Commission H. BOBEK and his collaborators carried out the epoch-making research into Central Places, an internationally unique achievement, for the ordinal rankings of services and, accordingly, central places were tested by a repetitive technique.

When E. LICHTENBERGER became head of the Commission the style of research was changed fundamentally and the tasks were redefined. With an analytical research technique using stochastic models instead of a presentation of results by means of maps and tables it was necessary to establish a data bank and acquire computer facilities. Special problems of regional planning required a special approach of computer-assisted research. Geostatistical programs, spatial data banks and software for computer graphics were needed. With respect to the

latter, the production of computer maps was, however, considered a sideline only, the main purpose being to use computer cartography as a research tool for rapid information as to the distribution of structures and processes in an iterative research technique.

Basic research into theoretical problems is one of the foci of the Commission. Thus, efficiency of research projects was studied by means of loss and profit accounts from the raw data to the research data proper *(cf. Figure 8)*, by considering the ratio of manpower, time and financial requirements for collecting and processing data and testing possibilities for optimizing the information structure.

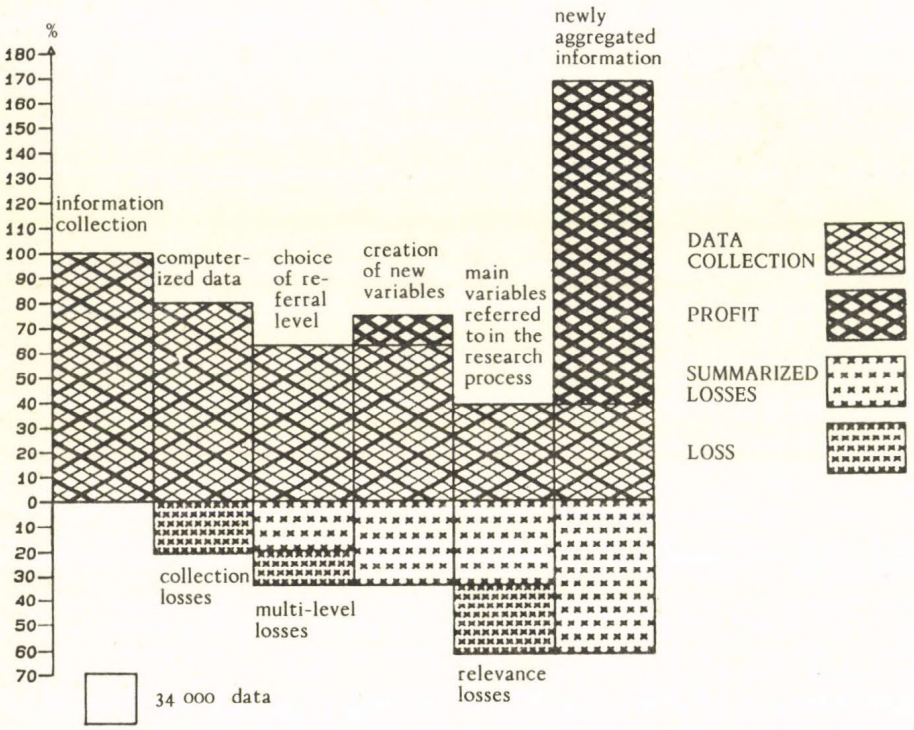

Fig. 8 Profit and loss accounts with respect to data in research project. Source: LICHTENBERGER, E. (1984): Gastarbeiter - Leben in zwei Gesellschaften. Vienna, Köln and Graz; Böhlau, 47

As to basic research into methodological problems the studies concerning multi-level-analysis, ecological fallacy and spatial autocorrelation ought to be mentioned.

The applicability of a multi-level-analysis in connection with factor analytical models was tested in research into guest-workers *(cf. Figure 9)*. it was possible to show that the effects of ethno-cultural pluralism regulate the segregation processes on the levels of urban districts and mobility

areas, structure the spatial information subsystems and influence financial behaviour. Generally speaking, they are independent of the persistent spatial system of the city including the organization of housing and work places.

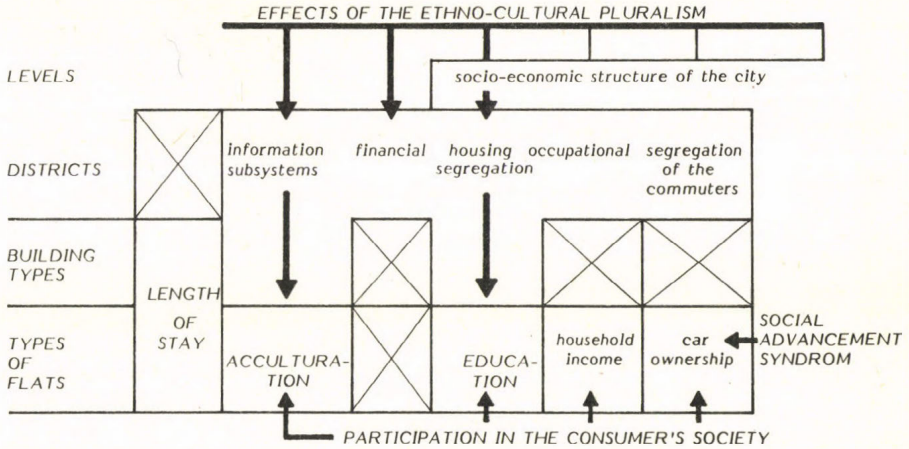

Fig. 9 Effects of the ethno-cultural pluralism and the participation in the consumers' society in a multi-level analysis of the city

A participation in the consumers' society could only be proved on the lowest level, that of flat types. It is manifest in a social rise syndrome of higher household incomes, better acculturation and car ownership on the part of the guestworkers.

These statements refer to an extensive research project on guestworkers the results of which were published in a book. It is singular in European research into guestworkers for the following reasons:

- two questionnaire studies, in 1974 and 1981,
- bilateral (Austrian-Yugoslav) cooperation and
- a new working concept of a bilateral superposition theory that
- necessitated a study of two spatial systems and, thus,
- an entirely new theoretical and methodological approach.

When holding that social reseárch of needs must reflect on clichés critically, one realizes that popular beliefs as to a possible substitution of the guestworkers in the labour market, their "parasitic" role in the social system and a traditional generative behaviour with a large number of children must be revised. The book shows that there is a growing socio-cultural distance in the long run, and, therefore, an increasing potential for conflicts between the guestworkers and the indigenous population of the receiving countries.

At present two projects scheduled for a number of years are being dealt with by the Commission:

- A project on urban blight in Vienna makes use of a house-

by-house survey in the built-up area of the Founders' Period as to commercial and residential blight. It is closely connected with the immanent problem of convergence or divergence in urban development within different political systems. Followers of a convergence theory hold that desurbanization as an innovative process will spread in Europe, too, from northwest to east, similar to the process of industrialization one century ago.

A *comparative study of Munich and Vienna* in cooperation with G. HEINRITZ (Munich) resulted in an international symposium on the *crisis of the central city and the take-off of suburbia*, with invited speakers coming from social welfare states in Europe, North American private capitalistic systems, Japan and countries of the Eastern Bloc. The papers read were published, in revised form, in the "Erdkundliches Wissen" series.

- The second project is part of the international *Man and Biosphere Program* and deals with the problem of a superposition of an indigenous population by the *leisure society* by means of a west-eastern profile through the Austrian Alps. Surveys were made in 10 communes so far and the data stored in a data bank.

Finally a few words should be said about the future scientific tasks of the Commission. When applying the heuristic principle of the product cycle to the work done by scientific institutions, one might say that the Commission is in the first phase of a new product cycle. Its tasks are

- to carry out pretests for extensive research projects and present model studies and test new methodological ways,

- to enquire critically into societal developments as an independent agency,

- to develop scenarios where this activity requires courage.

Last but not least it is the function of the Commission to act as an interface in international scientific cooperation and the transfer of theories and methods and to be an innovator for geographical research within Austria.

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NEW RESEARCH TRENDS IN GEOGRAPHY IN HUNGARY

by

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SUMMARY

Geographical research in Hungary has fundamentally been motivated by the main research direction entitled "Overall scientific investigation of the country's natural resources", initiated by the government and by the Hungarian Academy of Sciences. In addition to this, geography has taken part in research projects sponsored by various ministries, comprising

"Research into the directions of settlement evolution";
"Protection of the human environment";
"Protection of Lake Balaton".

The preparation of the new edition of the "National Atlas of Hungary" constitutes an interministerial program.

Progress in economic reform and emphasis on national economy has attached considerably more importance to the economic and social branches of geography.

It was realized that nature conservation and the protection of the environment and their relations to a judicious utilization of natural resources and raw materials need a monitoring system and a concept for an environmental economy that are essentially inseparable from each other. We believe that in a multidisciplinary research direction of service to a rational environmental economy the whole field of geography should play an important role, and this fact may increase the importance of both main branches of geography.

The results of other physiographic and geomorphological research fields are represented comprehensively in the publication entitled "Physical Geography and Geomorphology in Hungary (1986) edited by M. PÉCSI and D. LÓCZY.

Regional geography that had always been a separate geographical field with a predominantly individual spatial outlook has experienced a renaissance. Due to the necessity of evaluating elements of space, the landscape and the environmental potential, research views and tasks have drastically changed with conditions. The principle of regionality is no longer directed towards the interpretation of the uniqueness and heterogeneity of geographical spatial units but rather towards the investigation of dialectic homogeneity.

Into landscape monographs of Hungary, anthropocentric aspects were included while micro-landscape monographs and studies aiming at the delimination of micro-districts were supported by elaborating and applying computer and remote sensing methods.

ZUSAMMENFASSUNG

Dies ist ein kurzer, aber umfassender Bericht über die Situtation der Geographie in Ungarn und die neueren Forschungsrichtungen.

Seit einem Jahrzehnt ist in Ungarn die Betrachtungsweise erstarkt, nach der die Geographie als allgemeine Systemwissenschaft aufzufassen ist, welche nach der Erfassung der Gesamtheit der durch die Wissenschaften i.a. sowie auch aus ihrem eigenen Blickwinkel heraus beobachteten Phänomene strebt. Wir versuchen, die Erde und das "geographische Environment" als funktionelles Ganzes und die darin enthaltenen Faktoren, die von den anderen Wissenschaften jeweils getrennt untersucht werden, zusammen oder in ihrem Aufeinandereinwirken zu interpretieren.

Das geographische Environment der Gesellschaft wird nach meiner Interpretation damit nicht allein durch die Natur, sondern auch durch die Gesellschaft gebildet.

Aus dem gleichen Blickwinkel heraus werden auf der Basis der Systemtheorie die zu erwartenden ökologischen Konsequenzen technischer Großanlagen analysiert, und auf ähnliche Weise wird das Ausmaß der Inanspruchnahme der geographischen Umwelt durch die gegenwärtige Flächennutzung (z.B. in den einzelnen Komitaten) interpretiert.

Hierzu wäre - wie sich jetzt schon abzeichnet - der Aufbau und die Evidenthaltung eines geographischen Informationssystems von Nöten. Derzeit arbeiten wir daran, ein solches aufzubauen (L. GÓCZÁN, G. MEZÖSI, I. TÓZSA, T. SIKOS).

Die geographischen Forschungen in Ungarn sind grundlegend durch die von der Regierung als vorrangig erklärte Hauptforschungsrichtung "Umfassende wissenschaftliche Untersuchung des Naturkräftepotentials des Landes" motiviert. Innerhalb der auf ministerieller Ebene festgesetzten Forschungsprogramme führt die Geographie Teilaufgaben aus bei den "Basisforschungen zur Steuerung der Siedlungsentwicklung",
dem "Schutz der menschlichen Umwelt" und
dem "Schutz des Plattensees".

Als interministerielles Programm gilt die Herstellung und Neuausgabe des "Nationalatlasses von Ungarn".

Dadurch, daß die volkswirtschaftlichen Aspekte der Wirtschaftsreform zunehmend in den Vordergrund getreten sind, ist die Rolle der Wirtschafts- und Sozialgeographie schwerpunktmäßig hervorgehoben.

Nach unserer Erkenntnis erfordert die Beziehung zwischen Naturschutz, Umweltschutz und der rationellen Nutzung des Naturkräftepotentials ein System von Maßnahmen, die im wesentlichen untrennbar miteinander verknüpft sind, und eine planmäßige Bewirtschaftung der Umwelt.

Über die Ergebnisse der Forschungsrichtungen der Physischen Geographie und insbesonders der Geomorphologie in Ungarn gibt der von M. PÉCSI und D. LÓCZY herausgegebene Situationsbericht "Physical Geography and Geomorphology in Hungary" (Budapest 1986) zusammenfassend Auskunft.

Zum Schluß noch einiges über die Bedeutung einer bei uns von jeher dominanten Forschungsrichtung. Die Regionalgeographie, stets eine eigenständige, eine Sonderstellung einnehmende und die am meisten am Raum orientierte Forschungsrichtung der Geographie, ist in rascher Erneuerung begriffen. Ihr Forschungsaspekt und ihre Aufgabe haben sich entsprechend den Umständen, die in zunehmendem Maße die Bewertung des Raumes, der Landschaft und des Umweltpotentials erfordern, geändert.

Das Prinzip der Regionalität wird nicht mehr in erster Linie zur Interpretation der Individualität oder Heterogenität geographischer Räume, sondern eher zur dialektischen Homogenitätsuntersuchung benutzt. Es gilt zu ergründen, ob die Homogenität durch einen oder durch mehrere Faktoren bestimmt wird. Bei der "Mehrfaktorenhomogenität" besteht eine gewisse funktionelle Beziehung zwischen dem Raum und den untersuchten Komponenten. Dieses Prinzip leitet zur vergleichenden funktionellen Regionaluntersuchung über. Die

Funktionen des Raumes verändern sich schnell bzw. nehmen schnell zu. Die Interpretation dieser Umweltveränderungen und deren zielstrebige Untersuchung gibt dem Geographen die Möglichkeit zu einer Landschaftsdiagnose und -prognose.

Die Landschaftsmonographien Ungarns sind durch anthropozentrische Aspekte ergänzt worden, und die Bearbeitungen der Mikroregionen und die auf eine agrogeographische Mikrorayonnierung abzielenden Studien sind methodisch durch EDV und Fernerkundungsverfahren ergänzt worden (s. K. MOLNÁR's Bericht über die Mikrorayonnierung).

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INTRODUCTION

Bilateral meetings of geographers always provide a chance for an exchange of experiences and information. Moreover, the meetings might intiate or renew personal relations among the geographers of the two countries that may further research, the application of new research methods as well as a more appropriate application of these methods. Last but not least, these meetings may provide an opportunity for joint geographic research of international significance.

In addition to the advantages mentioned above I could name many more on the basis of experiences I have had together with other Hungarian geographers at bilateral geographic meetings in which participated experts of different countries during the past 25 years.[1]

Though officially this is the very first meeting between Austrian and Hungarian geographers, we know quite well that there was cooperation before (mainly in international research, e.g. into the Quaternary, int loess, in connection with the "Atlas of the Danube Countries" and into topics related to the Danube etc.) for three decades. The results of this cooperation were remarkable and very useful and were fully appreciated in both countries, i.e. by the Austrian and Hungarian Academies of Sciences and by the presidia of the Geographical Societies of both countries. Geographers active in the development and cultivation of these bilateral relations, were elected foreign members (J. FINK, M. PÉCSI) and honorary members (J. FINK, J. BREU, E. ARNBERGER, M. PÉCSI) by the top scientific authorities. Unfortunately, due to the sudden death of Professor J. FINK, part of this bilateral research was stopped. Nevertheless, our relations have been intensified recently, especially due to the efforts of Prof. Elisabeth LICHTENBERGER who, as the head (Obmann) of the "Kommission für Raumforschung" of the Austrian Academy of Sciences, organized our bilateral meeting of geographers here Vienna. I am sure that, whit this scien-

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[1] We have been organizing bilateral meetings on recent geographic research trends with French geographers since 1962, and for about two decades with Polish, Czechoslovak, West-German and American geographers. Proceedings of these meetings have been published regularly.

tific meeting, a new, fruitful and close cooperation between the geographers of the two countries will start. We shall make every effort to intensify our scientific contacts.

After this short introduction which certainly was no formal one, I should like, on behalf of the Hungarian participants, to thank the Austrian organizators of this meeting, first of all Prof. Elisabeth Lichtenberger, who has put in considerable effort to arrange this meeting. Besides I want to greet all the participants, and my special thanks are due to the Austrian Academy of Sciences, for sponsoring the organization of this meeting that might have come as a surprise.

On the occasion of this meeting it is my task to give a short outline of the state of geography in Hungary, on recent research trends and, within this framework of the research efforts as to establishing and improving geographic information systems. This topic is, however, too large and complicated. Therefore I cannot enumerate all of the individual branches of research and their results in detail. Here, I have an opportunity only to give you some information on the main tasks, scientific results and their application in practice as worked out by our Institute between 1981 and 1985 and published in English.[2]

1. ASPECTS OF GEOGRAPHY AND THE GEOGRAPHICAL ENVIRONMENT OF SOCIETY

The objects, goals and aspects of investigation of geography have been reformulated many times, in the course of the last century almost in each decade. It was not so much the objects of investigation that have changed but rather the points of view, due to the respective kinds of requirements both from the scholarly and social point of view.

Based on tradition but taking into account the recent requirements, the present task of geography can be described as follows: The object of geography is the systems theory-oriented investigation, interpretation, diagnosis, typification and prognostication of the changing spatial phenomena of the Earth's surface, i.e. of nature- and man-made forms, of their states, variations and changes, and of processes and relationships. This definition, of course, stresses the fact that individual branches of geography do not represent geography as a whole.

Simplifying issues of historical development, one might say that as early as at the turn of the 20th century some scholars regarded geography as a science of relationships, recently general systems science is seen in this light, with the latter aiming at surmounting the gulf between the natural and social sciences.

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2 Geographical Research Institute of Hungarian Academy of Sciences: 1951-1980. Editor: S. MAROSI

For the past decade, there has been an increasing trend in Hungary to regard geography as a general systems science that researches the totality of things observed, according to its own aspects though. We have tried to interpret the Earth, the geographical environment as a functioning whole, the integrative effects of factors in it or their interactions that are studied individually by other branches of science.

According to the general systems theory of Ludwig von BERTALANFFY (1939, 1972) there are or might be relations or laws that govern certain types of interacting factors. Geography has, traditionally, dealt with the investigation of such many-sided relationships and interactions. Recently geography has been required, however, to consider all of the spatial components and their effects even when interpreting only individual factors of the geographical environment. This obviously is a methodological peculiarity of a geographical analysis of space that has come into the limelight with the task of discovering and interpreting the relationships between nature and man and those within the geographical environment.

Thus, to my mind, the geographical environment of the society does not only comprise nature itself but also society together with the results of its activities, with interactions and their results as well (PÉCSI, M. 1974, 1979, 1984). The growing extent of interaction causes advantageous and disadvantageous developments of the geographical environment as a whole.

For a decade in Hungary, the basic principles mentioned above have been applied to arrive at a systems-theoretical multidisciplinary clarification of the interactions and relationships between man and natural environment. Thus, e.g. in the course of research into geographical ecosystems, this aspect was applied to the assessment of regional environmental potentials.

With a systems-theoretical approach, e.g. the expected ecological consequences of large technical installations as well as the present landuse in each county are being analyzed.

Naturally geography in Hungary was not able to develop suitably effective methods and gain sufficient experience in the field of systems-theoretical research to be able to study and interpret the whole of the geographical environment since it is so highly complicated, that to survey and interpret its state or forecast changes, can be realized only for certain segments by target-oriented teams. It is self-evident that a geographical or environmental information system cannot be dispensed with and, therefore, is being created (see the papers of L. GÓCZÁN, G. MEZÖSI, I. TÓZSA).

2. MODERN DEMANDS AND MAIN TRENDS EFFECTING GEOGRAPHY IN HUNGARY

When compared the significance of the two main disciplines of geography, i.e. the special branches of physical geography and social geography, one realizes that it obviously varies from time to time. In Hungary it is the government and the

ministries that designate long- and medium-term research tasks, define basic research directions and applied research development plans and make suggestions for scientific workshops. These are of considerable, probably of decisive importance for the impact of topics and on the evolution of the individual branches of science. Geographical research in Hungary has been motivated to a large degree by the main research direction at "The overall scientific investigation of the country's natural resources" initiated by the government and by the Hungarian Academy of Sciences. In addition to this, geography took part in research projects run by different ministries, namely:

"Research s establishing the directions of settlement evolution",
"Protection of the human environment";
"Protection of Lake Balaton"; and
"Research aiming at the improvement of soil fertility".

The preparation of a new edition of the "National Atlas of Hungary" is the focus of an interministerial program.

The progress of economic reform and a new outlook of national economy have considerably emphasized the role of the economic and social branches of geography. To ease the effects of the present disturbance of the economic balance and of the economic crisis the practical requirements mainly settlement geography and social geography were called upon to suggest adequate measures. These will be referred to by the reports of I. BERÉNYI, P. BELUSZKY and Z. DÖVÉNYI.

Recently growing problems caused by the interaction between man and nature rendered the protection of the environment necessary both from the point of view of ecology and economy. To our mind, nature conservation, the protection of the environment and a sensible use of the natural resources need strict guidelines for a system of measures that are essentially inseparable from a well-planned long-term economy. We firmly believe that in multidisciplinary research focusing on a rational economy protecting the environment geography in its entirety deserves an important role, and this fact may further the importance of both its main branches.

Within this extensive task only the outlines of which were mentioned interdisciplinary research into an estimate of environmental effects is in progress. In this the participation of geographical fields is indispensable. Recent tasks, e.g. an estimate of possible ecological consequences of the construction of a hydroelectric power plant in the Danube valley, of bauxite mining, of the utilization of karst and thermal waters, stressed the significance of research of many special branches of geogprahy and increased the number of aspects of former investigations (for details see the paper of L. GÓCZÁN).

Relief qualification, landscape and environment analysis aiming at the improvement of land utilization, for instance, triggered the development of the so-called *"environmental-geomorphological"* or *"engineering-geomorphological"* research approach. Both, the geography of settlements and social geography, supporting the geographical analysis of resettlement, marking industrial sites, the monitoring of the quality of the environment and of the circumstances of life, have increased their importance, too.

Geography and its special branches, in Hungary, provided results of practical value, forming the basis for various economic and administrative decisions.

National and international demands, bilateral cooperations and international obligations considerably affected the correlation investigations of loess in Hungary, of Quaternary forms and their formation. The organization of international symposia in Hungary provided an opportunity to spread the findings gathered in this field.

These results and those of other physio-geographic and geomorphological projects are described comprehensively in the publication entitled "Physical Geography and Geomorphology in Hungary" (1986) edited by M. PÉCSI and D. LÓCZY.

Within the framework of bilateral and multilateral international agreements aiming at the mutual support in research, research into urbanization and sociogeographic fields have also been in progress, and its results are reflected in joint publications of round-table meetings and seminars.

In the course of this short introduction of the main trends of geography in Hungary last but not least I should like to evaluate the traditionally predominating branch, i.e. *regional geography*. This always somehow separated trend based on mostly individual spatial views has experienced a renaissance. Due to the needs for evaluating space, landscape and environmental potential, research approaches and tasks have drastically changed in harmony with changed conditions. The principle of regionality does not focus on the interpretation of uniqueness and heterogeneity of geographical spaces but rather on the investigation of dialectic homogeneity. The question of whether homogeneity consists of one or more factors is to be raised. In case of multifactorial homogeneity the space components are in a certain functional relation with one another. This concept led to the investigation of comparative functional regions. As to the spatial functions sudden changes and/or "accumulations" may happen, the evaluation and detailed measurement of which (environmental changes) provide a possibility for landscape diagnostics and prognostics for the researchers in geography.

The landscape monographs of Hungary were supplemented with an anthropocentric view, while micro-landscape monographs and works aiming at the creation of micro-districts were supported by elaborating and applying computer and remote sensing methods (see the report by K. MOLNÁR on the establishment of micro-districts).

3. GEOGRAPHY AND ENGAGEMENT IN PUBLIC AFFAIRS

From the discussion above it follows that geography should engage issues concerning the society. Nevertheless, it should also take into account its duties in the evolution of science, since if basic research, the theoretical-methodological bases of our fields were neglected, this could be harmful for the future evolution of geography.

The present economic crisis has lasted for a long time,

social stress, trouble and difficulties have accumulated. In this situation, special social engagement is required from the sciences in general, and recently especially from the economic, technical and geographical sciences as well.

Geography practically always has been in close relationship with public affairs. What should the viewpoint, the research object of geography in this relation be like?

Are geographers able to suggest some useful measures in favour of the economic policy in the light of recent findings? I feel that, during the past five years, geography in Hungary has actively participated in research tasks set by the government on the one hand, and was able to contribute towards the preparation of certain political and economic decisions, on the other hand. Below I am listing some of the more significant topics:

- preparation of the land statute;
- introduction of the system of land evaluation and of the process of new land evaluation itself;
- expert reports were formulated for planning concepts on the government or ministry level, among others those for the scientific preparation of *settlement development*, for stating the ecological consequences related to the technical establishments of the Gabcikovo-Nagymaros hydroelectric station etc.

The evaluation of habitat from an economic viewpoint turned ecogeography in Hungary into a practically oriented and useful research direction that has specialized in determining the ecological suitability of agricultural regions for plant cultivation by means of computer-assisted methods (L. GÓCZÁN et al.). This new research trend allows the determination of the agro-ecological micro-districts of the country with exact delimitations. This may be a modern tool for specializing plant cultivation in a period deficient in funds and allows, at the same time, the determination of locational ground-rent values that are a component of the differential rent.

I believe that the most important tasks of both the nature oriented and the economic spheres of geography involve the measurement of environmental effects and the analysis of the environment itself. The quality of life and environment is a research object of distinguished significance that is, to my mind, the current task of geography for the present and for the near-future as well.

Some geographical series, periodicals and books published in Hungary

STUDIES IN GEOGRAPHY IN HUNGARY
Akadémiai Kiadó
Chief editor: PÉCSI, M.

No. 1 PÉCSI, M.: Ten years of physico-geographic research in Hungary. Akadémiai Kiadó, 1964. 132.

No. 2 Applied geography in Hungary. Ed. by PÉCSI, M. Akadémiai Kiadó, 1964. 211.

No. 3 Geographical types of Hungarian agriculture. Ed. by SÁRFALVI, B. Akadémiai Kiadó, 1966. 84.

No. 4 Land utilization in Eastern Europe. Ed. by SÁRFALVI, B. Akadémiai Kiadó, 1967. 88.

No. 5 Research problems in Hungarian applied geography. Ed. by SÁRFALVI, B. Akadémiai Kiadó, 1969. 203.

No. 6 PÉCSI, M.: Geomorphological regions of Hungary. Akadémiai Kiadó, 1970. 45.

No. 7 Recent populations movements in the European countries. Ed. by SÁRFALVI, B. Akadémiai Kiadó, 1970. 92.

No. 8 Problems of relief planation. Ed. by PÉCSI, M. Akadémiai Kiadó, 1970. 151.

No. 9 The changing face of the Great Hungarian Plain. Ed. by SÁRFALVI, B. Akadémiai Kiadó, 1971. 183.

No. 10 BENCZE, I.--V. TAJTI, E.: Budapest. An industrial-geographical approach. Akadémiai Kiadó, 1972. 168.

No. 11 Man and environment. Ed. by PÉCSI, M. and PROBÁLD, F. Akadémiai Kiadó, 1974. 245.

No. 12 Regional development and planning. British and Hungarian case studies. Ed. by COMPTON, P.A. and PÉCSI, M. Akadémiai Kiadó, 1976. 234.

No. 13 Rural transformation in Hungary. Ed. by ENYEDI, Gy. Akadémiai Kiadó, 1976. 116.

No. 14 Urban development in the USA and Hungary. Ed. by ENYEDI, Gy. Akadémiai Kiadó, 1978. 311.

No. 15 Development of settlement systems. Ed. by ENYEDI, Gy. and MÉSZÁROS J. Akadémiai Kiadó, 1980. 265.

No. 16 Environmental management British and Hungarian case studies. Ed. by COMPTON, P.A. and PÉCSI, M. Akadémiai Kiadó, 1984. 263.

No. 17 Environmental and dynamic geomorphology. Case studies in Hungary. Contribution to the First International Geomorphological Conference, Manchester 1985. Ed. by PÉCSI, M. Akadémiai Kiadó, 1985. 220.

No. 18 Loess and the Quaternary. Chinese and Hungarian case studies. Ed. by PÉCSI, M. Akadémiai Kiadó, 1985. 125.

No. 19 Problems of the Neogene and Quaternary in the Carpathian Basin. Geological and geomorphological studies. Contribution to the VIIIth Congress of the Regional Committee on Mediterranean Neogene Stratigraphy. Ed. by KRETZOI, M. and PÉCSI, M. Akadémiai Kiadó, 1985. 128.

No. 20 Loess and periglacial phenomena. Loess et phenomene périglaciaires. Ed. by FRENCH, H.M. and PÉCSI, M. Akadémiai Kiadó, 1987. 311.

No. 21 Paleogeography and loess. Pleistocene climatic and environmental reconstructions. Ed. by PÉCSI, M. and VELICHKO, A.A. Akadémiai Kiadó, 1987. 156.

MAGYARORSZÁG TÁJFÖLDRAJZA (Landscapes of Hungary)
Akadémiai Kiadó
Chief editor: PÉCSI, M.

No. 1 A dunai Alföld. (The Danubian Great Plain.) Ed. by MAROSI, S. and SZILÁRD, J. Akadémiai Kiadó, 1967. 358.

No. 2 A tiszai Alföld. (The Tisza Great Plain.) Ed. by MAROSI, S. and SZILÁRD, J. Akadémiai Kiadó, 1969. 381.

No. 3 A Kisaföld és a Nyugat-magyarországi peremvidék. (The Little Plain and the West-Hungarian borderland.) Ed. by ÁDÁM, L. and MAROSI, S. Akadémiai Kiadó, 1975. 605.

No. 4 A Dunántúli-dombság. Dél-Dunántúl. (The Transdanubian Hills. South Transdanubia.) Ed. by ÁDÁM, L., MAROSI, S. and SZILÁRD, J. Akadémiai Kiadó, 1981. 704.)

FÖLDRAJZI MONOGRÁFIÁK (Geographical Monographs)
Akadémiai Kiadó
Chief editor: PÉCSI, M.

No. 1 LÁNG, S.: A Mátra és a Börzsöny földrajza. (Physical geography of the Mátra and Börzsöny Mts.) Akadémiai Kiadó, 1955. 512.

No. 2 A Mezöföld természeti földrajza. (Physische Geographie des Mezöföld.) Ed. by ÁDÁM, L., MAROSI, S. and SZILÁRD, J. Akadémiai Kiadó, 1959. 514. Abstract in German.

No. 3 PÉCSI, M.: A magyarországi Duna-völgy kialakulása és felszínalaktana. (Entwicklung und Morphologie des Donautales in Ungarn.) Akadémiai Kiadó, 1959. 345. Abstract in German.

No. 4 ASZTALOS, I.--SÁRFALVY, B.: A Duna--Tisza-köze mezögazdasági földrajza. (Landwirtschaftsgeographie des Donau-Theiss-Zwischenstromlandes.) Akadémiai Kiadó, 1961. 228. Abstract in German and Russian.

No. 6 ENYEDI, Gy.: A Délkelet-Alföld mezögazdasági földrajza. (Agrogeography of South-Eastern Great Plain.) Akadémiai Kiadó, 1964. 316. Abstract: No. 1 of the series "Geographical Abstracts in Hungary".

No. 7 LÁNG, S.: A Cserhát természeti földrajza. (Physical geography of the Cserhát.) Akadémiai Kiadó, 1967. 375.

No. 8 JAKUCS, L.: A karsztok morfogenetikája. A karsztfejlödés variánciái. Akadémiai Kiadó. 1971. 310. English edition: Morphogenetics of karst regions. Variants of karst evolution. Akadémiai Kiadó, 1977. 283.

No. 9 LOVÁSZ, Gy.: A Dráva-Mura vízrendszer vízjárási és lefolyási viszonyai. (Surface runoff the Dráva--Mura drainage system.) Akadémiai Kiadó, 1972. 158. Abstract: No. 25 of the series "Geographical Abtracts in Hungary".

No. 10 Dunaújváros földrajza. Ed. by ÁDÁM, L. and BOROS, F. Akadémiai Kiadó, 1979. 319. Abstract published in a separate booklet: The Geography of Dunaújváros. By ÁDÀM, L. etc. Summary.Akadémiai Kiadó, 1980. 31.

ELMÉLET--MÓDSZER--GYAKORLAT (Theory--methodology--practice)
Geographical Research Insitute, Hung.Acad.Sci.

Since 1963 were published 42 volumes, out of these in foreign languages:

No. 6 PÉCSI, M.: Evolution and sedimentation of slopes during the Pleistocene glaciations in Hungary. Geographical Research Institute, Hung.Acad.Sci. 164. 10.

No. 8 PÉCSI, M.: Evolution of the floodplain levels of the Danube and their principal bearings on the geography of agriculture. Geographical Research Institute, Hung.Acad.Sci. 1966. 14.

No. 22 Recherches de l'environment, cartographie de l'environment, urbanisation et développement de l'environment. VII^{e} colloque franco-hongrois de géographie. Éd. par KATONA, S., KEREKES, S. Inst.de Recherches Géogr. Acad. Sci. Hongrie, 1981. 191.

No. 24 Quaternary studies in Hungary. Ed. by PÉCSI, M. Geographical Research Institute, Hung.Acad.Sci. 1982. 313.

No. 28 BELUSZKY, P.--SIKOS, T.: Tipologiya selskih naselennykh punktov v selskikh mestnostyakh strany. (Typology of rural settlement in Hungary.) Geogr.Inst.Vengerskoy Akad. Nauk, 1983. 38. In English: No. 26. of the series "Geographical Abstracts in Hungary".

No. 29 Geographical essays in Hungary. Ed. by ENYEDI, Gy. and PÉCSI, M. Geographical Research Institute, Hung.Acad.Sci. 1984. 349.

No. 30 Lithology and stratigraphy of loess and paleosols: Proceedings of the Symposium organized by INQUA Commission on Loess and Paleopedology, XIth INQUA Congress, Moscow. Ed. by PÉCSI,.M. Geographical Research Institute, Hung.Acad.Sci. 1984. 325.

No. 35 MAROSI, S.: Tájkutatási irányzatok, tájértékelés, tájtipológiai eredmények. (Trends in landscape study, landscape evaluation and landscape typological achievements in Hungarian test areas of various size and endowments.) Geographical Research Institute Hung.Acad.Sci. 1985. 115. Abstract in English: 105-119.

No. 38 Physical geography and geomorphology in Hungary. Ed. by PÉCSI, M. and LÓCZY, D. Geographical Research Institute, Hung.Acad. Sci. 1986. 124.

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SPATIALLY ORIENTED INFORMATION SYSTEMS OF GEOSCIENTIFIC DISCIPLINES IN AUSTRIA

by

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SUMMARY

Having presented a short introduction into the LIS problems in the geosciences, the geoscientific and geotechnical data acquired in Austria are described. They mirror the diversity of the 9 fields. Most of these data are already stored in about 40 data banks and might form the basis for a future geo-information system on a common geodetic basis.

ZUSAMMENFASSUNG

Nach einer kurzen Einführung in die LIS-Problematik der Geowissenschaften werden die in Österreich erhobenen geowissenschaftlichen/geotechnischen Daten beschrieben. Sie spiegeln die Vielfalt der 9 Fachgebiete wider. Ein Großteil dieser Daten ist bereits in etwa 40 Datenbanken verspeichert und könnte - auf einheitlicher geodätischer Basis - die Grundlage eines künftigen Geo-Informationssystems bilden.

1. INTRODUCTION

As the present author had organized a symposium on geoscientific and geotechnical data in land information systems (GeoLIS, 3-4 April, 1986, Vienna Technical University, cf. ref. 6) last year, he was invited to write a report on the geoscientific/geotechnical information systems existing in Austria at present. He is very ready to do so, but cannot do so without a few reservations:

+ Because of the great variety of geoscientific fields this report cannot be complete and is a subjective one.
+ The spheres of competence are not fixed legally - a situation rather agreeable for the scholar, but also leading to vagueness.
+ The author is mainly interested in "Geo" and not so much in "LIS". This report is considered a chance to further interdisciplinary cooperation with respect to information systems.
+ The author is well aware of the problem of terminology, but it will not be discussed here in detail. The most important terms are used according to the definitions given below:

(a) *Land information systems* (LIS), according to the definition of the Fédération Internationale de Geomètres (FIG) 1981, are instruments for legislation, administration and economy, devices for planning and development, consisting of spatially oriented data *and* matters for ... analyzing them, based on a spatial reference system ... which makes combinations with other data possible (cf. ref. 3).

LIS contain primary data (e.g. land registers, multi-purpose cadastre, data on drilling results) and are based on large-scale surveys, whereas *geographical information systems* (GIS) are systems with aggregate data (e.g. statistical information systems, deposit registers) and, therefore, less spatial resolution, though similar to LIS otherwise.

Spatial information system (SIS) is the generic term covering both LIS and GIS (cf. ref. 2,10).

(b) other abbrevations:

DB	data bank (GDB: land register)
IR	infrared-measuring flights
BEV	Federal Bureau of Standards and Surveying, Vienna
BMWF	Ministry for Science and Research, Vienna
BV(F)A	Federal Experimental Stations (Research Institutes)
FGI	Research Society Joanneum, Graz
FZS	Research Centre Seibersdorf
GBA	Federal Geological Survey, Vienna
GTI	Geotechnical Institute of the BVFA Arsenal, Vienna
HZB	Central Hydrographical Bureau, Vienna
MU	University of Mining and Extracting Industries, Leoben
ÖAW	Austrian Academy of Sciences
ÖBIG	Austrian Federal Institute for Health, Vienna
ÖMV	Austrian Mineral Oil Agency
TU	Technical University (Vienna, Graz)
VOEST	United Austrian Iron and Steel Works, Linz/Donawitz
ZAMG	Central Office for Meteorology and Geodynamics, Vienna
ZT	Consulting Engineers (Ziviltechniker)

2. ATTRIBUTES OF GEOSCIENTIFIC INFORMATION SYSTEMS

A geoscientific information system ("GeoIS") is a computer-assisted system as described in (1a), but used as an instrument for geoscientific/geotechnical research or pertinent decision-making in economy and administration (cf. ref. 6:3-4).

As opposed to a pure LIS, it mainly contains data on the upper layers of the subsoil, but there is little reference to legal aspects.

With respect to the data basis, GeoIS and LIS/GIS overlap as to relief, water bodies, landuse, raw materials. The basic methods for analysis and coordinate systems are the same, but data structures differ, on the one hand as to the spatial reference units - the geometrical information pertaining to each datum (e.g. measured value) - and on the other hand as to the quality of the data *(cf. Table 1)*.

Table 1 Attributes of geoscientific information systems

Structure of the data		LIS/GIS	GeoIS (examples)
spatial reference units	points	in rare cases only	many measurement values; soil samples, geological exposures
	lines	many (e.g. supply networks, traffic systems)	terrain profiles, waterbodies, tectonic lines, drillings
	areas	predominant (e.g. landuse types, socio-economic data)	terrain models, rocks, types of soil, climatic data
	spatial	hardly any	tectonics, rock bodies, alluvium
	temporal dimension	sometimes (e.g, statistics, topicality)	erosion, landslides glaciology, remote sensing
data source(s)		mainly public agencies, primary data (LIS) aggregate data (GIS)	public and private institutions raw data (mainly measurements) interpreted data
classification of data		relatively simple	often difficult
data quality (priority of aspects)		reliability (especially with LIS) precision topicality	representativeness spatial (e.g. drillings) temporal (eg. soil humidity) precision completeness measurement method applied

Because of the diversity of geoscientific fields, both the information contents of the data as well as the purposes of geo-information systems have a wide spectrum. R. BRUCKMÜLLER (cf. ref. 6:151) uses an impressive simile: "Each of these GEO-columns is constructed in another way, looks different and has another internal structure. All the time new columns are being erected, but... they are going to collapse, if there is no unifying roof added to protect them (against adverse meteorological conditions). A geo-temple coming into existence in this way... must be impressive with its diversity of columns."

With respect to communication between the different fields BRUCKMÜLLER falls back on experiences with mankind: "All attempts at having one common language accepted have failed. If we want to communicate, we must learn foreign languages. Even speaking the same language does not guarantee understanding ... In this geo-temple, it will be necessary to learn many foreign languages ... for in this way the individual will not remain confined to his own columns."

3. GEOSCIENTIFIC/GEOTECHNICAL DATA COLLECTIONS

The main problem in compiling my report is this diversity of geoscientific fields, approaches and specific terminologies. Certain communication problems between geologists and technicians might be considered a typical example for this. Other barriers against getting full information on geoscientific data banks consist in rivalry in research as well as in economic concerns (universities, research institutions, government agencies, technical consultants, industry, software firms, etc.). In this connection there often seems to be some fear of having to provide data or of misuse of data - a significant barrier against voluntary cooperation between private persons or institutes and public agencies.

Though the author was able to collect a wealth of information on other fields through the GeoLIS symposium, the summary given below must remain subjective. Into this overview according to specific fields, not just computer-assisted data collections were included, but also some that consist in maps or traditional files. The proper data banks are listed in chapter 4.

Geodesy:
(BEV, Survey Agencies, agencies of the provinces, TU, ZT, industry):
Measurements for fixing coordinates or describing movements (horizontal and vertical); lists of coordinates, terrain models, areas of landslips
cadastre (land register: owners, areas, landuse, indices of productivity...)
register of supply networks (type, situation, materials...)
vertical deflection and gravity measurements
remote sensing, photogrammetry
(refs. 6:9-27, 178-197; 7: 43-54, 12, 13: 52-55, 16)

Geomorphology:
(BEV, University Departments of Geography, ÖAW)
relief forms, classification, terraces, miniature forms, inclination, exposure to sun
natural hazards, erosion, geomorphological processes
(cf. refs. given under "geodesy"and 12:81, 15:167-177)

Geophysics:
(ZAMG, universities, MU, TU, GBA, BEV, oil industry, mining, FGI, GTI, ZT)
Gravimetric and rock density measurements
magnetometric (aero- and terrestric) measurements, rock characteristics
seismic measurements, measurements of deformation and of strain
geo-electrics, drilling-holes geophysics
heat conductivity, radiometrics
climatic data (cf. hydrology)
(cf. refs. 5; 6:28-36, 202-203; 15)

Geology:
(GBA, provinces, universities, TU, FGJ, GTI, building industry, mining, VOEST)
Thickness of rock layers, dip and strike, stratigraphy, type
type of rock, analyses of minerals and rocks, drillings
geochemical analyses (trace elements...)
chronology, fossils, genesis, erosion
deposits (including mass raw materials)
dumps (protection of groundwater resources)
(refs. 1; 4; 5; 6:37-61; 9; 12: 44-56)

Geotechnics:
(TU, universities, research institutes, building industries, mining, GBA, GTI, ZT)
Deformation studies (pressure, shearing strength, triaxial studies)
grain sizes, limits of consistency, friction angles
densities, E-modul
soundings, drilling, measurements of sagging
stratigraphy, clay mineral content, water-bearing layers
deposits, mining rights, dumps, areas of landslides
(refs. 1; 4; 5; 6:49-83; 15)

Hydrology:
(Central Bureau of Hydrography, provinces, electricity boards, GBA, GTI, ÖAW)
precipitation, evaporation, discharge
mean temperatures, hours of sunshine, climatic types
rivers (catchment areas), snow cover, glaciers
water level, temperature. sediment transport. water quality
groundwater level (maximum, minimum, variation),
currents, chemical situtation
(refs. 1; 5; 6:84-103; 8; 9; 12)

Pedology:
(Federal Bureau of Soil Economy, BVA of forestry, BVA of agriculture, FZS, Federal Research Institute for Hydraulic Engineering and Hydrology, University of Agriculture; research institutes)
Types of soil, thickness of soil-cover, parent rock
physical soil analyses (grain sizes, structure of pores, water balance)
chemical soil analyses (pH-values, humus content, limestone content, content of trace elements, nutrient content, pollutants)
biological soil analyses (enzyme activity, number of germs, analyses of plants and leaves)
carrying capacity, root penetration
relief forms, exposition, erosion
vegetation (potential, actual), locational units
(refs.: 6:104-127; 9; 11; 15; pedological maps, publications of the Austrian Society of Pedology)

Geoscientific-biological fields:
Environmental protection
(pedology agencies, Federal Environmental Agency, FGJ, FZS, GBA, GTI, ÖBIG, TU)
Measurements of samples and by remote sensing
Soil pollutants, damages through specific types of landuse, vegetation analyses, bioindicators, inventory of forest condition water supply, sewage, water quality of rivers, dumps, air pollutants and their transport, suspended particles
(refs. 1:25-30; 5; 6:119-138, 196; 12:38-65; 81-109; 13:69-73; 14)

Geobotanics, zoology, agriculture
(universities, research institutes, BVFA, FZS, ÖAW, scientific museums)
Vegetation studies and analyses, mapping of biotopes
distribution areas (flora, fauna, indicator plants, flowering times)
type of soil - fertility - fertilizing

4. GEO-DATA BANKS AND INFORMATION SYSTEMS

Of the data mentioned above about 40 percent are not stored electronically yet due to either a shortage of labour or the fact that storage is in graphical form; the percentage is especially high with geomorphology and pedology.

In the *Table 2* given below, some of the larger data banks are listed.
Value labels:
Status: 1 planned, 2 being created, 3 augmentation, 4 working
Precision of location: A 1-20 cm, B up to 10 m, C up to 500 m, D more than 1 km
With most of these data banks, the software systems listed below are being used:
ARC/INFO (USA/D, refs. 6:166-177;14): projects 43, 54, partly 6, 24

Table 2 Some geoscientific data banks and GeoIS in Austria

Nr	Name	Short description	Developed by	Status	Spatial units, precision type	main contents	(refs.)	combined with
1	GDB	land registers	BEV	4 3	lot, A	land register	(16)	2-4, 6
2	DKM	digital cadastre	BEV	2	point, A	digital land register (boundaries)		1-4. 6
3	KDB	coordinates data bank	BEV	3 2	point, A	fixed points boundaries		1
4	DGM DTM	digital terrain model	BEV TU, ÖMV	3 3	profiles B grid C	relief heights (from orthophotos or digitized Austrian maps 1:50000 to 1:200000)		1
5	RBW	spatial reference system Vienna	Vienna	3-4	block A/B network of streets	LIS (landuse, statistical and other data)	(6, 7)	1 and others
6		register of supply networks	communes	1-3	line A	underground supply network (location + type)		1
7	GSPP LAS	gravity field in Austria	TU Graz TU Vienna	3 2	point B point B	vertical deflection, gravity data and calculation of models	(6, 13)	4, 11
10	ÖSA	gravity register	BEV, ÖMV, Univ., ZAMG	2	measurement point B	gravity, gravity anomaly		11
11	DDM	digital density model	BEV, ZAMG, MU Leoben	3	grid C	rock density (upper layers)	(6)	4, 10
12		seismic data bank	ÖMV	2	profiles B	seismic refiexion measurements		4
13	AMVÖ	aero-magnetism	ZAMG, GBA	3	line/grid	magnetic anomalies (flight height <1 km)	(1)	4

Table 2 Some geoscientific data banks and GeoIS in Austria (cont.)

Nr	Name	Short description	Developed by	Sta-tus	Spatial units, precision type	main contents	(refs.)	com-bined with
20	GEOKART, GEOLIT		GBA	3-4	area C	geological maps, literature	(4)	24
21	GEOPUNKT, GEOPROJEKT		GBA	2-3	point	geological exposures, drillings		
22	GeoCh	geochemical survey	VOEST, GBA	2	area D	chemical elements in brook sediments	(1)	24
23		mining	Central Statistical Off.	3	branch	economic statistics		
24		deposits information	FGJ, ÖAW	2	area C	drillings, deposits in Styria	(6)	1, 4, 20
25	ROKAT OÖROK	mass deposits (part of GIS)	provinces (Lower Austria, Upper Austria)	2	area B/C	sand, gravel, quarries, groundwater areas	(1, 9)	42
30		characteristic geotechnical values	ZT, BVA, TU	1-3	point B	drillings, characteristic values of rocks		21 ?
31	ID	geotechnical data bank	Lower Austria	2	point B	exposures, drillings, samples	(6)	21
32	AWIDAB	register of dumps 84	ÖBiG	3	point C	2900 dumps (type, location, status)	(12)	42
40		hydrographical service	HZB	3	3700 points B	water levels, water temperature, flow precipitation		4
41	HÖ 3	water supply in Austria	ÖAW, HZB	2	catchment area C	precipitation, discharge, solar radiation	(6, 8)	4,40
42		groundwater data banks	Vienna, GBA, provinces, GTI	2	point, area	ground water level, currents, hydrogeological data		25, 40

43		ecosystem Danube storage lake	ÖAW	2	point	hydrology, groundwater Altenwörth		4
51	FI	Austrian forest inventory	Forstl. BVA	3	grid 2.7 km, 22000 cells	forest stands, type of soil, humidity (periodically)	(6)	52
52	WZI	inventory of forest status	Forstl. BVA	3	grid 4 x 4 km	health status, soils (yearly)		51
53		study of forest status	Vorarlberg	(3)	grid	forest stand, inclination of slopes (IR measurement flights)		4
			Vienna	(3)	partly grid	Vienna Woods, Lobau (IR + Scanner)	(12)	4,5
54	POLLAPSE	pilot project: demonstration forest Rosalia	FZS, Univ. of Agricult.	4	grid C	locational type, geology, meteorological data, pollution		4, 62
55		potential of natural landscape	Styria	2	area C	soil quality, geology, deposits, ground water	(1)	4
60	SUMKAT	Salzburg environmental register	Salzburg ÖBIG	2-3	measurement station B/C network of streets	vegetation, immission models, dust measurements	(12)	2, 4
61		Vienna environment study	Vienna, BMWF	2	RBW, grid B	vegetation, emission		4, 5, 42
62		forest damages study	ÖBIG BMWF	3	sample areas C	vegetation in Upper Austria, Carinthia; aerosol (IR measurements flights 1984/86)		

DESBOD/GTM (FGJ/TU Graz, refs. 6:160-165;13): projects 4b, 24, 55, partly 6, 32
GDB(BEV, Federal Agency of Statistics and Accounting, refs. 7,16): projects 1-4
GEOKART etc. (GBA Vienna, refs. 4; 6:42-48): projects 20, 21, partly 24, 25
Intergraph: project 32
SICAD (Siemens): project 53a
RBW (Vienna, TU Vienna, refs.: 6:19-27; 7): projects 5, 6, 42, 53, 61
TOPIAS/SCOP (TU Vienna, ref. 6: 178-189): projects 4, partly 11, 41

5. FINAL REMARKS

This report not only offers a chance to
- further contacts between geographers and other geoscientists and
- improve the understanding between social and natural sciences, but also to draw attention to the chances and problems of modern information systems for mankind.

Finally the author wishes to inform all Austrian and foreign colleagues interested in information systems that there will be a second GeoLIS symposium, probably in October 1988, at the Vienna Technical University.

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SPATIAL INFORMATION SYSTEMS FOR THE SOCIAL SCIENCES IN AUSTRIA

by

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SUMMARY

For the first time an attempt is made to present a survey of the main spatial information systems existing in Austria. Three questions are posed:
- Which institutions are able to develop or to implement spatial information systems?
- What are the main requests with respect to them on the part of the public?
- How can the architecture of the systems be described?

Three main results are pointed out:
(1) There is a variety of systems: In accordance with the federal structure of the Republic of Austria, the provinces have developed individual solutions for the administration of their spatial data.
(2) There is a concentration of funds: Spatial information systems are known to be costly tools in the hands of administration and science. Presently two essential issues are able to provide financing for such systems: problems of environmental pollution and issues of storage and management of information concerning private property.
(3) There is a division of labour between public administration and research: Since the mid-seventies, projects on the recording and, possibly, solution of environmental problems have been carried out predominantly in scientific institutions outside university. Public administration is mainly engaged in a nationwide inventory of more or less standardized data.

ZUSAMMENFASSUNG

Erstmalig erfolgt in dieser Arbeit eine Zusammenstellung der wesentlichsten Räumlichen Informationssysteme in Österreich. Drei Fragen strukturieren dabei die Übersicht:
- Welche Institutionen entwickeln oder implementieren Räumliche Informationssysteme?
- Was sind deren wichtigste gesellschaftliche Aufgaben?
- Wie ist der Aufbau derartiger Systeme beschreibbar?

Drei wichtige Resultate können herausgestrichen werden:
(1) Die Vielfalt der Systeme: In Übereinstimmung mit der föderalen Struktur der Republik Österreich überrascht es nicht weiter, daß die einzelnen Bundesländer eigene Lösungen bei der Verwaltung raumbezogener Daten realisiert haben.
(2) Die Konzentration der finanziellen Mittel: Räumliche Informationssysteme sind bekanntlich teure Investitionen für Wissenschaft und öffentliche Verwaltung. Es sind deswegen nur ausgewählte Fragestellungen in der Lage, entsprechende Finanzierungen zu gewährleisten.
(3) Die Arbeitsteilung zwischen öffentlicher Verwaltung und Wissenschaft: Seit den 70er Jahren ist die Sammlung und die Analyse umweltbezogener Daten vornehmlich in außeruniversitären Institutionen erfolgt. Die öffentliche Verwaltung ist hauptsächlich in der gesamtstaatlichen Erfassung von mehr oder weniger standardisierten Daten engagiert.

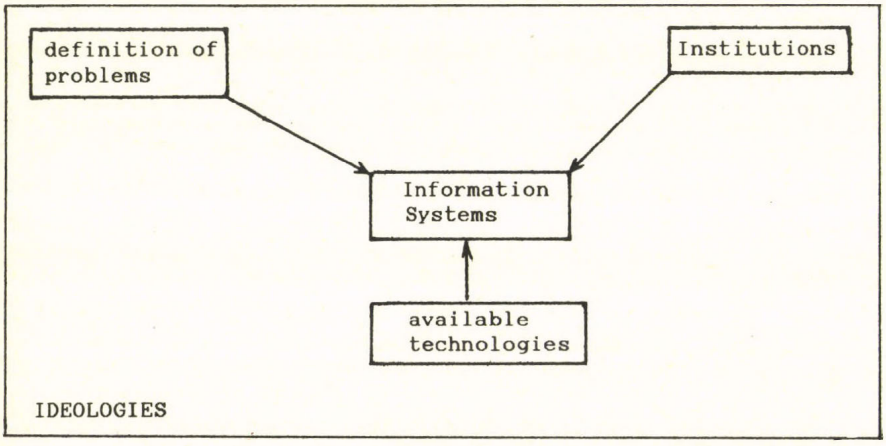
* * *

1. PREFACE

Information generally is regarded a prerequisite for deciding on, implementing and controlling societal meaures. Thus it is not surprising to find that state authorities have, for a long time, been showing manifest interest in information on such features as the number of inhabitants, the sizes of properties, registers of ownership-titles, etc. The forms of investigation and the types of information chosen as well as the kinds of indicators adopted are dependent on complex relations within a triangle of:
- the set of problems realized within a society,
- the progress of information technologies,
- and the separation of institutional tasks within a state.

They, in turn, depend on the respective dominant ideologies within a society (cf. *Table 1*).

Table 1 Factors influencing information systems



These conditions are reflected by the way data are integrated into a general or spatial information system. In addition to the fundamental crux of selecting appropriate indicators for the investigation of specific problems of society, spatial information systems (SIS) also have to cope with the selection of adequate units for the operationalisation. Here, a twofold dilemma - resulting from the institutional separation with regard to the collection and administration of data - becomes apparent:

- Their structures and tasks having developed historically, institutions only hesitantly adopt new relevant societal issues.
- Institutions possess their own traditional adminstrative spatial structures, which are incompatible with each other, and hence render genuine cooperation very difficult.

Spatial information systems (SIS) are recent developments in the fields of computer-assisted administration and processing of localizeable data.

As a consequence of the short history of SIS, it is hardly surprising to find

- that there is no standardized terminology yet and
- that the establishment of information systems on a national level is poorly coordinated.

The first of these aspects is being dealt with below.

2. DEFICITS IN TERMINOLOGY

In September 1986, an international conference took place in London on the acquisition, management, description and presentation of spatial data. The notion of "spatial information systems" (SIS) was to be found in 23 papers, either in their titles or else contained in the essay. Nine papers used the notion of "geographical information systems" (GIS), and another nine that of "land information systems" (LIS). The remaining contributions referred to "digital cadastral maps" or "land data bases" or else postulated a quasi-synonymity of the notions of LIS and GIS.

The examples given in literature are contradictory, too. In 1981, the International Union for Geodesy defined the notion of land information systems (LIS) in the following way:

"A Land Information System is a tool for legal, adminstrative and economic decision-making and an aid for planning and development which consists on the one hand of a data base containing spatially referenced land related data for a defined area and on the other hand of procedures and techniques for the systematic collection, updating, processing and distribution of data". (Zeitschrift für Vermessungswesen 1984: 119).

According to this definition, LIS comprise all other spatial information systems. Consequently, geographical information systems (GIS) are to be regarded as subsystems of a comprehensive land information system. Other authors perceive a reversed relationship between these terms: "The term land information system (LIS) is primarily used for cadastral and large scale applications,

whereas geographical information systems (GIS) may be regarded as a superset covering large and small scales." (KAINZ 1985, 1).

MARBLE, CALKINS and *PEUQUET* define GIS in even more general terms:

"Automated Geographical Information Systems have been developed to accept and generate large amounts of spatial data and to effectively and efficiently store, retrieve, analyse and present this information according to user specifications." (MARBLE et al. 1984; cit. in Ottens 1985: 1).

Below an attempt is made to clarify the terminology by referring to specific applications of the various terms.

"Räumliches Informationssystem", i.e. spatial information system (=SIS), can be regarded a generic term comprising all types of information systems relating to space, including all computer-assisted systems for the administration of spatially defined data, irrespective of their functions and the scales they refer to. Hence, a SIS includes

- geographical information systems (GIS),
- land information systems (LIS),
- and regional statistical data bases (RSDB).

With GIS the spatial component is defined exclusively by means of coordinate systems, LIS and RSDB make use of the postal address to fix the position of an object in space. GIS allow for the integration of different scales, are flexible as to the input and output of data (vector- or grid data), and perform specific analytic functions such as polygon overlay-computations, data aggregations, statistics procedures, etc. as well.

LIS, on the other hand, are useful in the complete inventorying of a limited set of variables at just one scale. The objects they refer to, such as allotments or blocks, often are fairly small; they frequently can be retrieved via some sort of address (postal code, street name, house number, etc.). Because of the high labour cost for a complete inventory items, LIS are normally implemented at the offices of national or local authorities.

RSDB refers to the large number of data bases fed with a multitude of particulars on medium- or small-scale statistical areas. A digitized map allows for a cartographic display of this information. The concurrence of spatial data and the respective digital polygons is effected by numeric codes such as commune codes. RSDB are implemented in national or communal offices as well as research institutes or commercial enterprises.

3. PRODUCERS OF SIS IN AUSTRIA

In describing and evaluating the existing SIS in Austria, the legal status of the respective producer will be taken as the point of reference. The structure of an information system is essentially dependent on its functions in the past and at present. The tasks of the Federal Statistical Offices differ from those of the Central Statistical Office; the latter, in turn, faces other demands than do scientific institutions. Below three institutional fields and their major SIS will be described.

3.1. Public administration on the national level

In Austrian ministeries, SIS containing specific information are the exception rather than the rule. There are only two agencies to be mentioned in this context (cf. *Table 2*).

Table 2 SIS in national administration

Name	Agency	Type	Data-Basis	Spatial Unit
ISIS	Central Statistical Office	RSDB	National census, forecasts, micro-censuses	Census units, Communes, political districts
DBG	Central Office f. Gauging and Surveying	LIS	Register of landed property	Allotments, parcels

3.1.1. ISIS

The Integrated Statistical Information System (ISIS) has been developed and is monitored by the Austrian Central Statistical Office. At present, it represents the most comprehensive data base for social and economic information in Austria. For a deeper insight into the special features of this data base and the Austrian situation in general, below a critical reflexion on it is given rather than a detailed description (for this, vide FUCHS, 1985).

In particular, the following three problems should be mentioned:

(1) The legally defined task of the Austrian Central Statistical Office is the carrying out of "specific" surveys and the publication of their results. There are, however, no subjects explicitly mentioned. Hence, it is to be decided within this institution just what information might be of societal interest. These conditions give rise to many problems. At times it is difficult to come to a resolution on what information might be required by whom; the need for a particular type of information can only be guessed at. Therefore there is a tendency towards a "stockpiling" of data.

The concept of this data base provides for 173.10E9 cells, of which, presently, some 1.10E9 only are filled.

(2) The installation of ISIS has merely brought about a different way of administering and presenting data. It did not result in a redistribution of weights or an inclusion of new aspects.

The information retrievable appears to be rather unbalanced in many ways. For example: Presently, there exist some 500 multidimensional data matrices at commune level. They pertain to the following topics (cf. *Table 3*).

There clearly are enormous information deficits, especially in the field of economics. Information on the employed also is scarce; data on the labour market (such as number unemployed, jobs offered, etc.) are lacking altogether. There are no data on the spatial infrastructure and on environmental issues such

Table 3 Spatial information available at the commune level

residences	26.7%
agriculture and forestry	25.9%
data relating to persons	20.3%
buildings	11.5%
work places, enterprises	5.6%
tourism	4.4%
households, families	3.8%
topographical data	1.8%

as noxious agents, acid rain and its effects on forests, records of traffic loads, etc.
(3) The structure of ISIS allows for the storage of pre-processed multidimensional data matrices only (6 dimensions on average). As a consequence, users cannot retrieve any desired combination of particulars, but are to put up with an a priori defined combination.
(4) Another consequence of this restrictive structure is the fact that the availability of information decreases with spatial disaggregation (cf. *Table 4*).

Table 4 Spatial disaggregation and decrease of information in ISIS

	multidimensional matrices	decrease of information in %
Austria on the whole	5374	100.0
Federal provinces	3421	63.7
Political districts	1075	20.0
Judicial district	122	2.3
Commune	515	9.6
Census district	48	0.9
Census ward	130	2.4

3.1.1. Digital land register - digital cadastral map

The second data base on the national level in Austria is based on the computerized recording of land register information. Between 1978 and 1984, the "Bundesamt für Eich- und Vermessungswesen" has had the information of the so called A-, B- and C-records of some 12 million parcels computerized. Throughout Austria, all local surveying departments as well as many notary's office are connected online to the data bank.

What information does the Austrian Land Data Bank contain?

(1) Location: administrative district in which the real estate unit is located, its address and reference number on the real estate reference map.
(2) Owner: name(s) and homes address(es) of the owner(s).
(3) Size and unit value: size of the unit and its tax assessment value.
(4) Encumbrances and easements: mortgages with name of holder and servitudes benefitting the real estate unit.

For the next decade, a digital recording of the cadastral maps is planned. Some 132 000 cadastral maps will be computerized in the individual surveying departments. Eventually, a complete network of parcel boundaries will be available, with some elementary information on the utilization of plots, to be combined with other data banks via the postal address.

When applying the model of factors influencing information systems referred to above, to this particular LIS, it becomes apparent that:

- the problems to be solved are easily definable with respect to land registers. Essentially, these pertain to the protection of private property and to the assessment of taxes. The objectives of a digitized land register correspond closely to national concerns and, hence, are codified accordingly.
- There are no overlaps between the spheres of interest of the individual institutions.
- Finally, computerization of the land register can be realized with standard software available on the market.

So, the LIS of the Austrian Office for Gauging and Surveying has been lucky in meeting with a precise definition of tasks which made the conceptual work that much easier. Regarding the large number of allotments in Austria (3.5 times larger than that of the renowned Swedish LDB), this institution's precise organization and timely realization of this project deserves praise.

3.2. Federal Statistical Offices

SIS in the offices of the federal provinces have rather restrictive objectives, mainly assisting local regional planning, by processing relevant, spatially disaggregated information. Both, an inside-orientation and an autonomy of the statistical offices regarding the configuration and installation of SIS, results in a plurality of strategies adopted.
This is demonstrated in *Table 5*.

Table 5 SIS in the Austrian provinces

Province	Name of SIS	Type
Burgenland	- no SIS available -	-
Carinthia	- no SIS available -	-
Lower Austria	ROKAT	LIS (hybrid)
Upper Austria	OÖROK	LIS (hybrid)
	OSIRIS	RSDB
Salzburg	STADAS	RSDB
Styria	STIRAS	RSDB
Tyrol	SITRO	RSDB
Vorarlberg	- no SIS available -	-
Vienna	RBW	LIS

Some provinces, namely Vorarlberg, Carinthia and Burgenland, have no SIS at all. Others, such as Lower Austria and Upper Austria, have created "hybrid" SIS, with some subjects having been computerized, others, however, still only being accessible

in the traditional form of foliated maps. Moreover there are a number of small-scale SIS serving the specific purposes of certain administrative bodies.

Of this multitude of information systems, two are described in more detail below, i.e. the SITRO of the Tyrol, and the RBW of Vienna. Each of them has a special feature:

- SITRO has been one of the earliest developments, and
- RBW is one of the most complex information systems in Austria.

3.2.1. Statistisches Informationssytems Tirol für Raumordnung (SITRO) (Statistical Information System of the Tirol for regional planning)

The *concept of SITRO* corresponds to that of a RSDB. The system originated in the early seventies. Inspite of little manpower available and a modest technological infrastructure (IBM 1131 with an 8k CPU!), an information system with the following features was created:

- storage, administration and documentation of spatial data,
- data aggregation,
- report generator,
- statistical analyses,
- cartographic output.

A multitude of spatial concepts of particular institutions have been realized in the Tyrolean SIS. Data have been grouped, for example, according to forestry districts, zones served by mountain rescue bodies, cableway regions, local tourism associations etc., thus accounting for the variations in economic, social and habitat conditions of the Tyrol.

The main aspects are: land use, especially agriculture,tourism, infrastructure, professional and occupational composition of the population, demographic data, buildings, housing, and the financial policies of the communities.

3.2.2. Räumliches Bezugssystem Wien (RBW) (Spatial Reference System Vienna)

The RBW is a second example for a close correspondence between societal tasks and institutional scopes. It dates from the second half of the seventies, its major objective being the automated production of a 1:2000 city map. Its repertory grid consists of the computerized boundaries of blocks and of census areas at different scales. A great number of objects (e.g. tramway lines, elements of the sewage system, gas- and water pipelines, electricity mains, tree tops, etc.) are filed separately, rendering possible the generation of planning-oriented maps.

The system has been extended since. After the installation of a comprehensive address file, data relating to objects - provided they can be identified by street names and house numbers - can be connected to the topological coding of statistical areas. Thereby, this spatial reference system contributes considerably to an integration of the communal statistical information available.

The organization of communal statistics is, however, promoted by the fact that streets and blocks both constitute an ideal network of line- and area-type elements and are comparatively persistent features. A reference net like this, moreover, constitutes

a potential tool for communal management objectives. Depending on the kind of software installed, it could be applied of a wide spectrum of issues (DANGERMOND 1984).

3.3. *Scientific institutions*

It is very difficult to assess the installations of SIS in the scientific field. Numerous applications, some of them restricted to special problems only, have been developed; only some are known to the author. An information system provides scientific institutions with a twofold advantage: They are in a position to react to new societal issues and requests immediately; there can be a rather vague division of institutional scopes. However, SIS in the scientific field frequently tend to grow cumulatively as a consequence of diversified projects. This may adversely affect both the documentation of the software and the balance of particulars on register (cf. *Table 6*).

Table 6 Spatial Information Systems in scientific institutions

Name	Producer	Type	Data Basis	Spatial Units
IDA	ÖIR	RSDB	Subset from ISIS special analyses	Commune
VEGI	ÖBIG	GIS	Aerial views of the vegatation in Vienna	Optional, varying
	TU Wien	GIS	Digitized altitudes	Grid
ARC/INFO	ÖFZ Seibersdorf	GIS	Record on forest damages, "Rosaliengebirge	Optional
ARC/INFO	Research Inst. Joanneum (Leoben)	GIS	Recording of raw materials	Optional
ARC/INFO	University of Agriculture	GIS	Hydrological projects	Optional
INTER-GRAPH	Umweltbundesamt	GIS	Several	Optional
DESBOD	Research Inst. Joanneum (Graz)	GIS	Several	Optional

Abbrevations:

ÖIR	Österreichisches Institut für Raumplanung
ÖBIG	Österreichisches Bundesinstitut für Gesundheit
TU	Technical University
ÖFZ	Österreichisches Forschungszentrum Seibersdorf

The installation of a SIS frequently means a substantial financial and manpower investment on the part of the scientific institutions. As a consequence, information and software develop-

ments are often shielded from immediate competitors. With SIS being vital production factors, at times similar systems are being developed independently, frequently even on the same host. This aspect will be dealt with below.

4. CHARACTERISTICS OF SIS IN AUSTRIA

4.1. Federalism versus centralism

In accordance with the federal structure of the Republic of Austria, the provinces have developed individual solutions for the administration of their spatial data. Due to a close connexion between a demand for information and its administration, the data base of the various provinces differ in structure.

When comparing national solutions for SIS with foreign ones, a similarity between Austria and the Federal Republic of Germany (see: SÜDFELD, 1986) becomes apparent. There, too, the individual statistical offices of the federal provinces have established SIS, but there is no central SIS.

4.2. Sectorial approaches

Considering the factual objectives and functions of individual SIS, a typical pronounced sectorial demarcation is to be observed. This suggests that the new technological developments and instrumental facilities have not succeeded in breaking up traditional disciplinary boundaries, in spite of the fact that SIS would be an excellent methodological tool for interdisciplinary projects.

Any sectorial restriction, however, also produces specific deficits. Thus, the SIS of the Austrian Central Statistical Office (ÖStZA) lacks all particulars on such domains as environmental questions, categories of land use, soils, climatic conditions, etc. On the other hand, GIS applications in projects on the environment ignore social parameters or else do not provide exhaustive large scale information. The major reasons for these shortcomings have been identified above.

4.3. Concentration of financial resources

SIS, and particularly GIS, are known to be costly tools in the hands of administration and science. For this reason, and with regard to restricted financial resources, the concentration of funds on projects of major interest is both, an inevitable and sensible measure. In particular, the following two essential public requests are to be dealt with preferably:

- problems of environmental pollution
- and issues of storage and management of information concerning private property (data bases for real estate).

Another characteristic of SIS in Austria is that questions typical for GIS, such as an optimal economic utilization of specific areas, are clearly losing significance. This distinguishes the objectives of the applications in Austria from those e.g. in Hungary.

Since the mid-seventies, projects on the recording and, possibly solution of enviromental problems have been carried out predominantly in scientific institutions outside university (Österreichisches Bundesintitut für Gesundheit, Österreichisches Bundesumweltamt, Forschungszentrum Seibersdorf). One can therefore assume, that a further concentration of financial funds on particular institutions outside university will take place in future.

4.4. Future developments

The production of the digitized cadastral maps will probably create the largest research potential for future applications. Two perspectives ought to be considered:

- Census information can be linked to information of the land register and the cadastral map via the postal address.
- Network of boundaries of statistical units at various levels will allow for a multitude of applications and will also make different SIS compatible with each other.

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GEOGRAPHICAL INFORMATION SYSTEMS IN AUSTRIA

by

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SUMMARY

Based on the concepts developed by D. BARTELS, the author arrives at a pragmatic definition of "geographical information systems": He uses this term for systems in which both the input and the output is in the form of tabular and cartographic information and can be supplemented by pictorial information.

ZUSAMMENFASSUNG

Auf der Basis des räumlichen Bezugssystems von D. BARTELS wird ein pragmatischer Zugang zur Definition von "Geographischen Informationssystemen" vorgestellt. Als solche werden Systeme verstanden, bei denen sowohl bei der Eingabe als auch der Ausgabe tabellarische und kartographische Informationen verwendet werden sowie ein Ausbau durch Bildinformationen erfolgen kann.

* * *

1. PRELIMINARY REMARKS

At present it is a fairly difficult task to report on geographical information systems in Austria: On the one hand there is a tumultous development in the field of both hardware and software, especially as to graphical input and output. On the other hand problems concerning the environment, landuse conflicts and ecological imbalance are gaining increasing importance. There is a sort of boom, therefore, of spatially oriented information systems that are able to store, process and retrieve pertinent data. Tremendous efficiency is expected, but one tends to forget that first of all the right questions must be formul-

ated by the users of such systems. In real politics these questions normally concern almost exclusively singular facts (e.g.: What changes in the ecological conditions are to be expected when a certain dam is being built?), thus many information systems are created for a specific purpose and a specific area. Therefore there is a large number of attempts of creating geographical information systems, but no standardized, long-term system covering all of Austria. An overall concept on a meta-level ought to be formulated. Even the technical terms used lack a standardized definition. Coordination, based on an exchange of information, gains greatly in importance for arriving at a true multiplicator effect.

This need for coordination has been recognized by a few public and semi-official organizations, and they have become increasingly active in this field, e.g. the Österr. Raumordnungskonferenz (cf. ÖROK, 1986), an institution financed by the authorities concerned with regional planning on the level of the state, the province, the cities and the small communes.

2. THE DEFINITION OF TECHNICAL TERMS

Especially three terms should be defined clearly (cf. SAUBERER, 1986):

(a) the term of "information" and its delimitation against that of "data",
(b) the term of "information systems" and
(c) the adjective "spatially-oriented".

ad (a): The terms of "data" and "information":
Very often it is pointed out that the substantial difference between "data" and "information" is to be heeded: Data are numerical representations or other symbolical surrogates, representing human beings, organizations, objects, events or concepts. Information means data structured in a way so that an insight into, and a recognition of, a specific phenomenon becomes possible (NIJKAMP & RIETVELD, 1984:4). Thus an information process is based on a systematic data transformation. An information process takes place when the decision makers are given an insight into a specific task by providing logically organized data. Therefore information can be given through a number of activities in handling data, e.g.:

- systematical arrangement,
- verification (test of validity),
- classification,
- grouping,
- aggregation,
- calculation (carrying out numerical operations),
- prognostication,
- simulation,
- storing,
- retrieval,
- transfer and communication.

ad (b): The term "spatially-oriented information systems":
A spatially-oriented information system must, therefore, fulfil

all software and hardware requirements for representing information in the sense defined above. As TÜRKE (1984) states, the term of "information systems" is to be used in an increasingly wider sense. Whereas in the midseventies a spatially-oriented information system still was, primarily, a computer system combined with spatially-oriented data and methods of processing and representing them, this "monolithic definition" is opposed to a highly comprehensive one: "Therefore, a spatially oriented information system is the overall knowledge stored in the brains of co-workers, traditional media (such as book and maps) as well as electronically stored and retrievable data files, that can be made use of systematically for the description, prognostication and planning of spatial processes" (TÜRKE 1984:198).

ad (c): The type of spatial interrelations:
The type of spatial interrelations in information systems is of utmost importance and may differ in quality. High quality, in this case, denotes a wealth of details and marked flexibility. In literature there is confusion as to a definition of this interrelationship. An unconventional dichotomy only rarely used that seems to be very clear and logical was introduced by BARRACLOUGH (1984):
(1) *The names method:* The spatial units are defined by a name or a statistical code. This information does not provide a direct clue as to where this unit is located in space. All of the traditional statistical data banks make use of this method.
(2) *The allocation method* provides for an absolute allocation by means of geographical coordinates. Thus, areas can be defined by polygon pointers.

Recently, the focus is on the latter because especially problems of settlement and environmental politics can only be dealt with with this type of spatial interrelation. Such systems are termed *geographical information systems* (cf. CURRAN, 1984).

Comprehensive geographical information systems do not only process information on areal units, lines and points delimited by means of coordinates, but also so-called "grid-oriented" information, i.e. referring to a standardized spatial grid (e.g. subdivision of a territory by means of square of equal size), as well as traditional statistical information. Thus, a geographical information system normally comprises both an areal and a grid data bank as well as a general statistical data bank.

Other important features of spatially-oriented information systems include
(1) complete coverage of the reference area as opposed to a partial one.
(2) Homogeneity as opposed to heterogeneity.
Homogeneous spatially oriented information systems consist of areal reference units of the same dimension, that is: all of them are either points or lines or areas, heterogenous ones contain areal reference units of different dimensions.
(3) Regularity as opposed to irregularity.
In regular spatially-oriented information systems the areal reference units are regularly distributed. They include the grid square pattern mentioned above as well as evenly distributed points (e.g. measurement station). With irregular spatially-

oriented information systems the areal reference units are not distributed regularly (e.g. networks of boundaries of communes). Figure 1 depicts the basic system of spatially oriented information systems.

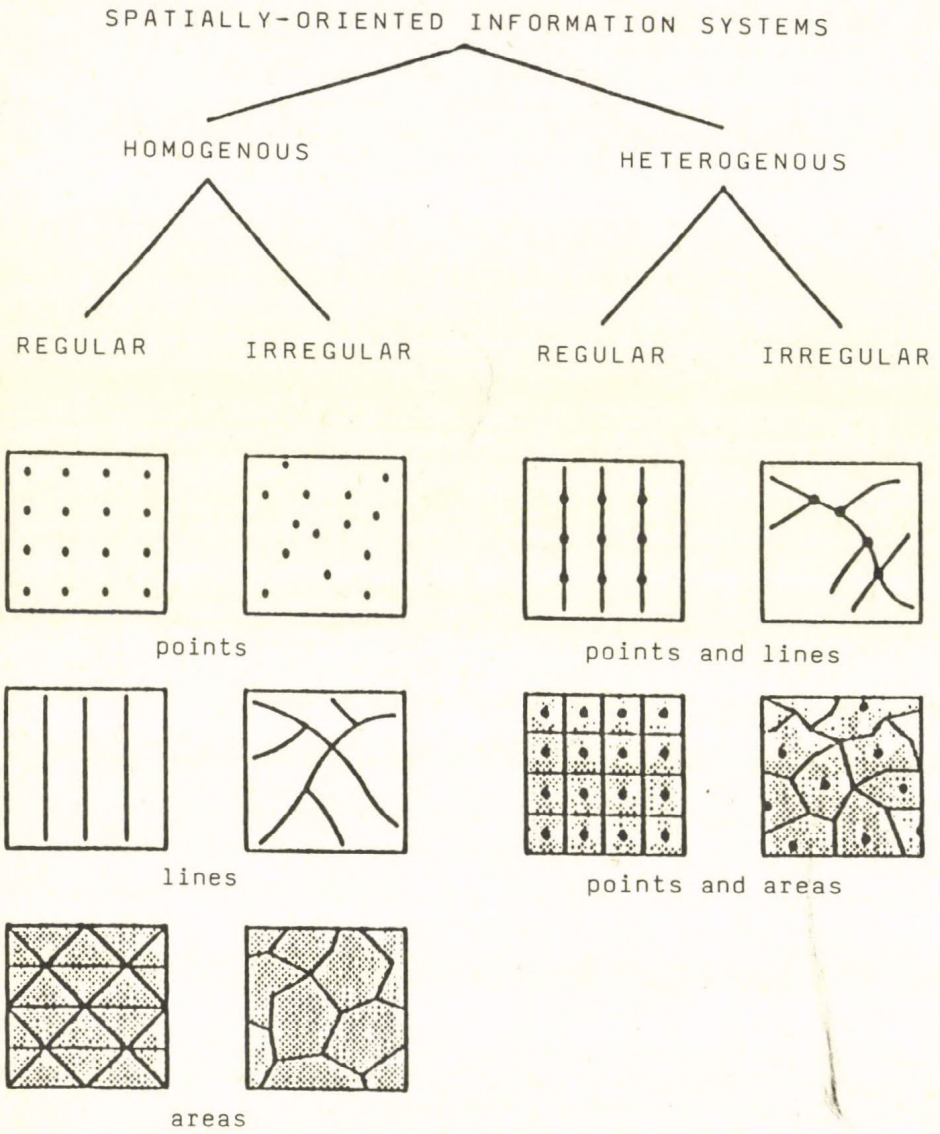

Fig. 1 Basic systems of spatially-oriented information systems (according to BARTELS 1981)

Digital photo processing forms the basis for a new type of geographical information systems. Aero- or satellite photographs are the input, thus it is possible to create and analyse new thematic layers systematically and as to temporal trends. Figure 2 presents the classification of spatially oriented information systems with respect to input and output media.

input medium	output media		
	Table, list	and map	and photograph
table, list	data bank system with regional data	data bank system with map output	-
and map	-	geographical information system	-
and photograph	-		geographical information system with photo interpretation

Fig. 2 Classification of information systems according to input and output media

3. TYPES OF GEOGRAPHICAL INFORMATION SYSTEMS IN AUSTRIA

Of the various criteria feasible for a typology of geographical information systems only two are referred to below:
- dimensions of the area covered (from small pilot areas to all of Austria),
- numbers of thematic layers (i.e. the number of variables included).

Below examples are given for systems covering all of Austria with just one or a few thematic layers.
- The Bundesamt für Eich- und Vermessungswesen (National Survey) stores data on plots (number, area, landuse, owners, number in the land registry and details listed there). This data bank is no geographical system proper yet, but will be turned into one, step by step, storing the data of the cadastral maps, too.
- It also stores relief data (based on a system developed in cooperation with the Vienna Technical University).
- The Österreichisches Statistisches Zentralamt obviously intends to create a system with various thematic layers by combin-

ing address files of houses and enterprises (about 1,6 million objects) with lots data. In the long run certainly further important thematic layers can be added.
- A number of geographical information systems consist of various thematic layers, but they only cover individual provinces or parts of them (cf. ÖROK, 1986).

4. IMPORTANT ASPECTS OF FURTHER DEVELOPMENT

(1) It appears absolutely necessary to develop geographical information systems that are tied up with regional data information systems, thus combining ecological questions with socio-economic ones.
(2) Though geographical information systems ought to be in the foreground, traditional regional data information systems need some augmentation, too. The storing and processing of interaction data (e.g. data on commuting, mobility and goods transport) ought to be given priority. Moreover statistical data on the environment and landuse are in demand. "Subjective data" (results of questionnaire research) should be stored systematically to a larger extent as well.
(3) In future an information system will consist of a great number of decentralized partial systems with a netlike structure. There is no need for centralization, but better communication and cooperation should be established.
(4) All systems existing should be made accessible more easily and by a larger spectrum of users.
(5) If possible, the systems should be made international, especially as national boundaries are of no significance in studying environmental problems.
(6) Fundamentally, demand ought to be given priority over supply. Therefore, politically relevant poblems should form the basis for developing and adequate information system. Information nowadays is overabundant, therefore even the most modern computer systems cannot cope with them, unless there is some sort of preselection according to a general concept.
(7) In future, the focus should be on what can be actually realized. In the past many attempts of creating information systems failed, because attempts had been made to cover too wide a spectrum and personal, financial and, also, intellectual resources had been inadequate.
(8) Integrative approaches should, however, be given priority over preparing highly specialized thematic layers. Especially with geographical information systems thematic layers of various fields ought to be combined.
(9) Another decisive aspect in the further development of spatially-oriented information systems is the demand for giving brain-ware absolute priority. Both hardware and software are well developed already, but ways must be found to apply this modern technology economically. "Artificial intelligence" will not be able to replace the concepts for spatially-oriented information systems developed by man. They form the very basis for creating an information system and constitute the guideline as to efficiency and the possibilities for making political

use of the results. In future, compatibility of information will have to be secured by brainware, that is: basic research in various scientific field. With respect to computer makes compatibility will be arrived at more easily, but data transfer will remain impossible as long as the approaches towards acquiring data will differ (e.g.: different theoretical concepts and methods in mapping biotopes and in classifying landscape units as well as different scales).

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GEOGRAPHICAL INFORMATION SYSTEMS IN HUNGARY

by

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SUMMARY

From the beginning of the 1970's, it has become possible to take measurements as to ecological systems, to combine information gained from maps and charts, and to store data and generate new ones on the basis of a new synoptic view because of the introduction of computer systems. Expedient information systems were created enabling us to carry out environmental surveys more effectively, in more detail, and more economically. It is necessary to work out computer methods and adapt them in order to build information systems, and that is why nowadays it is considered a way of assessing a country's scientific level by measuring up to what extent it is provided with information systems.

There are 7 or 8 significant and functioning data banks in Hungary, and there are experiments done to improve them into information systems. The following systems will be adaptable in a short time:

Soil Information System (MTA TAKI)
Agrochemical Information and Management System (MÉM NAK)
Surveying and Map Data Bank (FÖMI)
Areal Statistical Information System (VÁTI, KSH)

Data is being fed into the following systems:

Recreational Information System (VÁTI)
Environmental Protection Information System (OKTH)
Recultivation Information System (KFH)
Creating the Complex Environmental Information System is under way in the Geographical Research Institute of the Hungarian Academy of Sciences.

ZUSAMMENFASSUNG

Seit Anfang der 70-er Jahre, d.h. seit der verstärkten Verwendung der Computertechnik, besteht die Möglichkeit, die Erfassung der ökologischen Systeme, Verknüpfung der Karten- und Tabelleninformationen, die Speicherung der Daten und Generierung neuer Informationen usw. aufgrund einer neuen synoptischen Betrachtungsweise, eines anderen Herangehens

durchzuführen. Seitdem konnten zahlreiche zielgerichtete Informationssysteme aufgebaut werden, durch welche die Umweltforschungen wesentlich effektiver, genauer, rationeller ausgeführt werden können.

Zum Aufbau der Informationssysteme sind neue angewandte Verfahren der Computertechnik auszuarbeiten und zu adaptieren, so ist es kein Zufall, daß immer wieder der Grad der Ausrüstung mit Informationssystemen als Kennwert des wissenschaftlichen Niveaus des betreffenden Landes betrachtet wird.

Zur Zeit bestehen in Ungarn etwa 7 bis 8 solche bedeutende computerisierte Datenbasen, an denen auch Versuche zur Weiterentwicklung zu Informationssystemen durchgeführt werden. In kurzer Zeit können wahrscheinlich die nachstehenden Systeme benutzt werden:

Bodeninformationssystem (MTA TAKI),
Informations- und Regelungssystem für Agrochemie (MÉM NAK),
Datenbank für Geodäsie und Kartographie (FÖMI),
Regionales Statistisches Informationssystem (VÁTI, KSH).

In den folgenden ist gerade die Datenaufnahme im Gange:

Informationssystem für Rekreation (VÁTI),
Informationssystem für Umweltschutz (OKTH),
Informationssystem für Rekultivation (KFH).

Im Forschungsinstitut für Geographie der Ungarischen Akademie der Wissenschaften wird gerade daran gearbeitet, ein komplexes Informationssystem für Umwelt aufzubauen.

PREFACE

All over the world there is increasing interest in, and need for, evaluating and managing environmental systems due to a continuning devastation of natural ecological systems. It is ever more important to find and apply speedy and effective measures for "planning" the environment (USBECK, H. 1985).

Whoever is dealing with ecological problems must realize that is becoming increasingly difficult to provide exact theoretical and methodological information about the environment, as it is becoming more and more complex. Therefore, it deems necessary to gain insight into a wider spectrum of relationships in the complex mechanisms of ecological systems and it is also important to examine the capabilities of ecological units and evaluate the stability of different systems. For all this, naturally, new methods are required. Thus, e.g. there are more maps and air photos available, but we find we are unable to compare them directly.

We do hope that an increasing number of people will realize that solving these problems fundamentally is the task of geography (OPENSHAW, S. et al. 1986). No doubt the justification and efficience of geography will be assessed on the basis of the answers given to such questions.

As from the early 1970s it has become possible to monitor ecological systems, to integrate information gained from maps and air photographs, to store data and generate new ones on the basis of a new synoptic view. All this has become possible with the introduction of computer systems. We have created information systems which enable us to carry out environmental surveys more effectively, more precisely, and more economically (TOMLINSON, R.F. 1984). It is necessary to develop software

and adapt it in order to create information systems. That is why a way of ascertaining a country's scientific level consists in examining to what extent it is provided with information systems.

2. GEOGRAPHICAL INFORMATION SYSTEMS (GIS)

In Hungary "GIS" can be interpreted in a wider or narrower sense. In the wider sense, GIS is a general information system, with data entered, stored, and evaluated on the basis of a well-defined spatial system. In this sense GIS is synonymous with "spatial information systems". By GIS a complete system of environmental factors is denoted, which makes it possible to enter, transform, store, and process data in order to get new information, to be utilized in geographical research and in practice as well.

Computerized GIS include a data bank and the methods needed for processing, storing, and transferring data. Thus, there are three distinct components:

- data system (entering, transforming and storing data)
- processing system (data processing)
- control system (validity and reliability, simulation models).

2.1. Data system

One of the most important tasks of any specialized or integrative environmental research is collecting and processing data for getting hold of information. The data bank is a sort of storehouse of data only for normally they have no meaning without being further processed. When compiling the data bank we have to decide what system will be used (RHIND, D.W. et al. 1984).

Nowadays several institutions and agencies have such data systems in Hungary. On the one hand, therefore, it has become easier to compile a suitable data basis, on the other hand, however, this involves several unanswered questions as well. For instance, the data may have been compiled from several sources - e.g. remote sensing, maps and field-studies. These data may significantly differ in their informative value and reliability. It might be difficult to make use of them, as some of them are stored in grid form (e.g.: remote sensing data) and some of them in vector form. Costs are also to be considered in connection with data: Data banks tend to become more and more expensive because their price includes that of the processing technology in an indirect way, too.

2.2. Processing system

A GIS includes the techniques that are necessary for extracting information, and in the case of computer systems software for statistical techniques is part of its structure (BALÁZS L. 1987).

In connection with geographical information systems not only quality, capacity and reliability are required, but compatibility as well. Because of the complexity, bulk and price of environmental data to be used of course only the very best systems available are being used, thus enabling us to advise planners and decision makers in the best manner possible.

Because of the specific way environmental and spatial geography progresses, concepts and logical models seem to be lagging behind the technical possibilities.

In a simplified way, one might distinguish two types of data engineering and processing systems used in Hungarian research into landscapes and the environment. One of them collects data and prepares topical maps, the superimposing of several of them may yield the desired result then, the other one acquires data according to an integrated data bank system, thus arriving at a synthesis. Both approaches normally rely on classification and generalization in order to reduce the large mass of data though these methods have great disadvantage as success or failure greatly depend on the classification methods applied. In future problems solving with the help of GIS obviously will bring about a great step ahead as far as quality is concerned, a the data can be stored in full, thus different systems for classification and typifying can be applied.

2.3. Control systems

"Good" results can not be expected with "good" data. Data are, however, not the only feasible source of errors when using in GIS, processing methods and models applied might also be responsible.

3. GIS IN HUNGARY

At present the availability of geographical information systems reflects the fact that Hungary is still a little behind hand in comparison with Western European countries as to technology. In Western European countries, the main task is to make full use of the existing technological means and methods, whereas we are at the stage of experimenting as to problem solving with a GIS background, and of adapting internationally used techniques. Using GIS on a wider scale is hardly possible because pertinent new software for storing and analysing geographical data is not widely distributed. We are not know well versed in data processing methods yet, and many people still doubt their effectivity, though information systems are already used in simple computer cartography and digital terrain models.

A. At present there are about 7 or 8 important data banks existing in Hungary, and attempts are made to develop them into information systems.

The following systems will be available soon:

Soil Information System (MTA TAKI)

Agrochemical Information and Management System (MÉM NAK)

Surveying and Map Data Bank (FÖMI)

Areal Statistical Information System (VÁTI, KSH)

Data are being collected for the following systems:

Recreational Information System (VÁTI)

Environmental Protection Information System (OTKH)

Recultivation Information System (KFH).

There are three problems in connection with these systems:

- It is very important to make sure that these data bases are compatible. Effectivity is seriously impeded if data bases have different systems for storage and retrieval. This problem will be solved by means of a uniform identification system called "geocode" that is to be used according to a ministerial decree.
- The accessibility of the data presents a serious problem as the legal, financial and technical prerequisites are not defined yet. That's why a great deal of valuable data are not accessible yet.
- So far both software and expertise are not available for extracting complex information from the data.

B. The creation of a Complex Environmental Information System is under way at the Geographical Research Institute of the Hungarian Academy of Sciences. It is based on the following principles:

- To our mind, only one data bank should exist for each type of datum. Several copies mean a lot of extra work and extra sources of error. This, of course, does not mean that we should store all geographical data in one giant data bank, but that individual physical units should be organized on the same plan (Environmental Informations Sytem, *Fig. 1*). In our case, it will correspond to that of the already existing information system described above. The authorities concerned are responsible for the accessibility and functioning of these data banks.
- These data banks will be connected to the Standardized Data Recording System, which is to organize the entering and processing of the data.
- We want to ensure that the system works and many data are available by making it compatible with the already existing and functioning ARC/INFO, MAP, ARIADNE information systems by applying their principles.
- Considering our hardware facilities we feel that greater emphasis must be on the already existing storage capacity than on a giant rough calculating capacity.

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AN INFORMATION SYSTEM CONCERNING THE GEOGRAPHICAL ENVIRONMENT

by

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SUMMARY

In the Geographical Research Institute of the Hungarian Academy of Sciences, an information system concerning the geographical environment was elaborated with the aim of regional evaluation by means of a micro-computer.

The basic structure of this system consists of a question formulated digitally and a grid containing qualificational values - providing the answer. The functional approach of the information system is given by the individual data bases. The data base is represented by digitalized thematic maps of the society's physical and technological environment. The dimensions of the graticule are adaptable and depend on the wealth of details available for the basic data, and on the scale of the thematic maps. The digitalization comprises the effects of climatic conditions, hydrological situation, the relief-conditions, geology, soil characteristics of the examined territory and the socio-economic activities influencing or tainting them. These data are stored on flexible magnetic floppies, in the form of code numbers. Questions must be put in the form of weighted code-numbers, as the input data.

The question is always aimed at where what degree of suitability is ensured by the integrated effects of both the physical and technological environment with respect to a specific economic activity. When composing the question we have to take into consideration those factors of the physical and technogene environment which promote or restrict the given economic activity and the degree of the influence. So we have to weight the status of the factors and the code-numbers representing their qualities according to it.

The micro-computer program assigns scores to the basic units of the covering graticule, covering the examined territory by a simple additive weighting. Then it orders the qualificational values according to 10 intervals between the minimum and maximum scores. An output of the graticule filled with values is prepared by a matrix-printer. The values evaluate the suitability of the basic units of the examined territory for certain economic activities. This provides the answer to the question raised, the output consists in this pertinent information. So the system is giving some kind of specific economic information by means of the weighted and integrated evaluation of the factors of the environmental data-base.

The program is tested at the moment and is being developed further permanently. It is tailored to those types of micro-computers which are wide-spread in Hungary and are within easy reach.

The configuration consists of a C 64 (Commodore 64) basic micro-computer, enlarged by a C 64 plus extension, a dual floppy drive, No 8250, by a matrix-printer, a Centronix interface and a colour monitor.

ZUSAMMENFASSUNG

Am Forschungsinstitut für Geographie der Ungarischen Akademie der Wissenschaften wurde 1986 eine für einen Micro-Computer vorgesehene Version eines geographischen Umwelt-informationssystems für Gebietsbewertung ausgearbeitet.

Eine digital gefaßte Frage und ein mit Qualifizierungswerten erfülltes Gitternetz - als Antwort - bilden die Grundstruktur des Systems. Die Funktionsbedingung des Informationssystems wird von einem Datenbasis gesichert. Die durch ein Gitternetz digitalisierten thematischen Karten der natürlichen und technogen Umwelt der Gesellschaft vertreten diese Datenbasis. Die Geländegröße des Gitternetzes kann beliebig bestimmt werden bzw. sie hängt von der Ausführlichkeit der zur Verfügung stehenden Basisdaten bzw. vom Maßstab der thematischen Karten ab. Durch das Gitternetz werden die klimatischen Gegebenheiten,die "gewässergeographische" Lage, Geländeverhältnisse, Geologie, Bodeneigenschaften der zu untersuchenden Gebiete sowie die kartographisch faßbaren Wirkungen der beeinflussenden gesellschaftlich-wirtschaftlichen Faktoren digitalisiert. Die Daten werden auf flexiblen Magnetplatten in Form von Code-Nummern gespeichert. Die Frage ist in Form von gewichteten Code-Nummern als Input-Daten zu behandeln. Die Frage bezieht sich jeweils darauf, wo und inwiefern auf dem untersuchten Gebiet die einzelnen Wirtschaftstätigkeiten durch die natürliche und technogene Umwelt und ihre integrierte Wirkung begünstigt werden. Bei der Fragestellung muß berücksichtigt werden, welcher Faktor der natürlichen und technogen Umwelt in welchem Maße diese oder jene Wirtschaftstätigkeit unterstüzt bzw. beeinträchtigt. Dementsprechend sollen die Zustände der Faktoren bzw. die diese vertretenden Code-Nummern qualifiziert werden. Das Computer-Programm verwendet für das untersuchte Gebiet, d.h. die einzelnen Einheiten des betreffenden Gitternetzes, eine einfache additive Punkte-Bewertung; zwischen Maximum und Minimum werden zehn Stufen festgelegt. Das mit Bewertungspunkten ausgefüllte Gitternetz wird von einem Matrix-Printer ausgefertigt. Die Eignung für gewisse Wirtschaftstätigkeiten der einzelnen Einheiten des untersuchten Gebietes wird durch diese Bewertungspunkte gekennzeichnet. Das ist die Antwort auf die gestellte Frage, nämlich der Output, d.h. die information. Das System erbringt nun durch Bewertung der Faktoren der Umwelt-Datenbasis gewisse bewirtschaftungsspezifische Informationen.

Das Programm ist bereits funktionsfähig, wird jedoch noch ständig weiterenwickelt. Es ist auf den in Ungarn am weitesten verbreiteten und zugänglichsten Micro-Computertyp abgestimmt. Die Konfiguration wird von einem Commodore 64 mit C 64 plus Ergänzung, einem 8250 Dual Floppy, einem Matrix-Printer mit Centronix-Schnittstelle und einem Farbmonitor gebildet.

* * *

1. PREFACE

In 1986 we elaborated an applied research process in the Geographical Research Institute of the Hungarian Academy of Sciences that enables us to evaluate the factors of our physical environment (e.g. soil, water, air...) in an integrated form, from the point of view of certain specific economic activities (TÓZSA I., TÉCSY Z. 1987a,b).

The aim of this information system concerning the geographical environment *is to give information about the location of those territories which have either the most favourable or the most unfavourable conditions from the point of view of an economic activity.* The operation of the information system is divided into three stages: At first we develop the *data-base* containing factors of the physical/environmental potentials of the given area, then we summarize the list of environmental demands and limits of each economic activity calculating the so-called *'suitability indices'* and at last we compare the data-base and the indices of suitability and elaborate *'evaluational maps'* (MAROSI S., SZILÁRD J. 1963, MAZUR, E. 1983).

2. DATA BASE

We have accomplished to develop the data base of the information system concerning the geographical environment by interpolating graticules on maps of the examined territory. The units of the grid pattern can cover a few hectares or several hundred square-kilometres, depending on the capacity of the system. We put a graticule on *thematic maps* and copy the data provided digitally i.e. the spatial distribution of various environmental factors (HÖNIG, H. 1984).

Only those factors of our geographic environment can be stored in the data base which are represented in a map, i.e. their presence or their effects achieved in situ. They comprise *characteristics of soils* (type in general, physical types of soils, permeability or water-containing capacity, chemical reactions, humus- and lime content, thickness and soil erosion); *climatic conditions* (temperature during the growing-season, precipitation, snowcover, cloudiness, risk of frost, hail, rime-frost, velocity of winds and their direction, etc.); *relief conditions* (type of relief, steepness and exposure of slopes, their stability); *geological and geophysical conditions* (rocks, mineral resources, geothermal springs, geomagnetism, gravity, isogeotherms, seismicity, tectonics); *hydrogeographical conditions* (ground-water level, superficial- and abyssal supply of water, run-off conditions).

Beside the physical/environmental conditions mentioned above the information provided by thematic maps of the factors of the man-made, anthropogenic environment can be added too, to the data base of the information system, e.g. the factors of *environment-pollution* (the quality of superficial and abyssal water, the pollution of the ground-water, air-pollution, environmental radioactivity, air- and soil pollution of industry and traffic, noise, consuming of total quantity of fertilizers) and the factors of *land-use* (land-use, proportion of built-up area, density of road and rail-networks, forests by wood-types, landscape and touristic attractions, the number of stock of game).

As the spatial distribution of the information provided by the geographical information system appears in the form of a map, the data on factors that are not located in a specific place, or those whose effects do not appear in situ, cannot

be added to the data-base. They are characteristics of the socio-economic situation and factors of the cultural-political sphere (PÉCSI, M. 1984).

3. SUITABILITY INDICES

We store the numerical thematic maps of the data-base about the physical environment transformed by physical and man-made/anthropogenic activities on data-floppies. Thus these *thematic maps* appear in the data-base in the form of *data-matrices, consisting of code-numbers.* These code-numbers represent the quantitative and qualitative data for each of the environmental factors. (Different code-numbers represent e.g. the quantity of precipitation or a specific soil-type).

The *suitability indices* are *composed of a series of such code-numbers.* At first we select an economic activity for which we would like to get an information from the system, with respect to the way factors of physical and man-made (transformed) environment ensure favourable or unfavourable conditions in the examined territory (e.g. the large-scale growing of sunflowers). For this we have to examine the factors of our data-base and their quantitative and qualitative conditions in the form of code-numbers. With the help of specialized literature we determine which conditions or qualities of the factor have an unfavourable or favourable effect from the point of view of that particular economic activity. We also determine the degree of favourable and unfavourable conditions and weight them. Accordingly *weighted code-numers give the suitability indices.*

By means of the data base of the physical and the already transformed environment we can calculate suitability indices from the point of view of specific economic activities or their environmental impacts for the *agricultural production* (ZELENSKY, K. 1980). (E.g. that of maize, lucerne, onions, sugar melons, cherries); for the *threat of environment hazards* (e.g. acidity, acid rain, air, soil and water pollution, harmful noise); for the *effective examination* of *natural resources* favouring or restricting the location of economic activities (e.g. relief, climate, evaluation of mineral and water sources from the point of view of agriculture, tourism, transportation or industry).

4. 'EVALUATIONAL MAPS'

The map-like information of the geographical information system is displayed by a matrix-printer and on a colour TV-monitor. This information is in the form of *evaluational maps.* A simple *computer-program* compares the code-numbers provided by the data base to the weighted code-numbers of the suitability indices, giving a score to all of the matrix-units, according to the weighting. Examining all the code-numbers of the data base it

summarizes the grid-values, then it marks 10 intervals between the highest and lowest values. The program provides each cell of the matrix (graticule-unit) with a score from 0 to 9, from the view-point of suitability for plant-growing, e.g. '0' means that the given matrix-unit represents an area in which the conditions provided by physical/environmental factors are, relatively speaking, the most unfavourable ones for that kind of plant.

On the other hand, '9' means that the environmental factors altogether give the, relatively speaking, most favourable conditions for growing a specific type of plant. In the case of environmental pollution scores are reversed: here '0' means that the effect of environmental pollution in the concrete unit (e.g. harmful noise) is smallest, (e.g. in a town) on the whole territory examined. '9' points to the presence of the, relatively speaking, greatest rate of polluting effects.

5. DIMENSIONS

The dimensions of the information system depend upon the detailedness of the data in the data bank and on the scale of the maps available (GÖLZ, B. 1986). If we use a large-scale map and have highly detailed data, we can examine an individual settlement and its outskirts, or a physical-geographical micro-region. In this case the dimension of the information system is *local*. If the maps and data are on a medium scale, we can deal with a county, a part of the country, or a physical-geographical mezo-region. The dimension is *regional* in this case. With small scale maps and little detail as to data we get information about countries, the dimension is *global*.

6. APPLICATION

The data-storing and evaluating program of the information system concerning the geographical environment is written in BASIC and was tailored to a COMMODORE 64 micro-computer that is easily available for almost all of the economic, planning and directing institutes in Hungary. The information system mentioned above can be applied in the process of *preparing concrete economic plans*. It can give assistance especially in the field of *agriculture* and *environmental management*.

When having a detailed data base, i.e. in a *local dimension* (e.g. in the area of an agricultural cooperative), it can give concrete help for decisions on growing any specific plants by delimiting the area with the most favourable physical conditions, or, e.g. it can give the position of the districts within a town that are most or least threatened by air-pollution.

The *regional dimension* can provide help for economic decision on the level of counties by outlining regions suitable for certain economic activities, or areas to be reserved for environmental protection.

Last but not least it can support, on a *global level* the work of the environmental and agricultural world organization by, e.g., integrating the territorial statistical data, or by visualizing them on maps.

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II. REMOTE SENSING AND ECOLOGY

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SPACEBORNE REMOTE SENSING FOR REGIONAL PLANNING: APPLICATIONS IN AUSTRIA

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SUMMARY

In this paper an attempt is made to point out the potential of spaceborne remote sensing data for the application in regional planning and to outline the present activities in Austria. The major sensors are described and fields of application listed. It is stressed that effective use of remote sensing data can only be achieved if they are integrated into a digital geographic information system which must include a digital terrain model. The possibilities for future remote sensing applications in Austria are described.

ZUSAMMENFASSUNG

Es wird der Versuch unternommen, das Potential von Fernerkundungsdaten aus dem Weltraum für Raumplanungsbelange aufzuzeigen und die diesbezüglichen Aktivitäten in Österreich zu umreißen. Zunächst werden die wesentlichsten bisher verwendeten Sensoren kurz beschrieben und verschiedene Einsatzbereiche aufgelistet. Es wird betont, daß eine effiziente Nutzung von Fernerkundungsdaten nur durch deren Integration in ein digitales geographisches Informationssystem, welches auch ein digitales Geländemodell umfassen sollte, möglich ist. Anmerkungen zu den in Österreich vorhandenen Möglichkeiten für die Fernerkundung werden gemacht.

* * *

1. INTRODUCTION

Today, remote sensing techniques and especially those based on spaceborne systems, can already be considered as operational methods to be used for geography and regional planning in par-

ticular. In principle, almost all available remote sensing data, whether photographic or electronic (passive as well as active) can be utilized. The trend clearly is towards a synergetic application of multiple remote sensing data sets. The enormous advantage of all these data is the possible synoptic view of large areas using only one or a few scenes of homogenous quality.

In Austria, too, efforts have been made to exploit the potential of remotely sensed information for geographical problems and also to integrate this information into simple spatial information systems (IPCC 1986). Early examples of computer-assisted investigations of multispectral satellite imagery exist of the Hohe Tauern Range (BUCHROITHNER 1983a) and of the area around Graz (LEBERL, RAGGAM & RANZINGER 1983).

2. BRIEF ACCOUNT OF MAJOR REMOTE SENSING DATA SETS UTILIZED IN REGIONAL PLANNING

Since 1972 Landsat MSS data are available for Austria, and for most years one reasonable coverage for each season exists. The Austrian Solar and Space Agency (ASSA) which also acts as the National Point of Contact (NPOC) for ESA-Earthnet, keeps an up-to-date register of all the data acquired over Austria. The same is true for Landsat TM data, the earliest of which date back to December 1983. MSS as well as TM imagery has frequently been used in Austria for various geoscientific projects, mostly in research, however (cf. section 4).

The Systeme Probatoire d'Observation de la Terre - SPOT - is the most recent development of spaceborne scanners. It was launched in 1986. Operating from an altitude of some 820 km, its HRV instruments acquire data of 20 m by 20 m resolution in three spectral bands (green, red and near infrared). Moreover, panchromatic data (0.5-0.9 micrometer) with a resolution of 10 m are collected.

Presently (end of 1986, beginning of 1987) only a few SPOT image data of Austria exist. Their quality is varying. No research into, or application of, them has so far been made. The Institute for Image Processing and Computer Graphics in Graz was, however, one of the very first institutions world-wide to offer an operational software system for a stereo-evaluation of SPOT image pairs at an analytical photogrammetric plotting device (BUCHROITHNER 1987a).

The U.S. American research satellite for the Heat Capacity Mapping Mission (HCMM) was launched in 1978. The sensor covers a swath 716 km wide in the visible/near infrared and in the thermal infrared domain during day time and in the thermal infrared during night time. The resolution of the data (nadir range) is around 500 m by 500 m in the short wave range and about 600 m by 600 m in the long wave one. The grey values of the thermal imagery reflect, in the range of -15° to +7o °C, temperature differences with an accuracy of about 0.1 °C. The reception of HCMM data had to be stopped after a two years' period of operation. Some 1500 orbits over Europe have been recorded and several excellent images of the Eastern Alps' area exist. Some of them have already been exploited for climatical investigatons (BUCHROITHNER 1987a).

The other two types of spaceborne remote sensing data derive from systems bound up with the U.S. Space Shuttle. The first one is the Zeiss Metric Camera (MC) operated by the European Space Agency (ESA), the other one the NASA initiated Large Format Camera (LFC) from ITEK. Up to now, both photogrammetric cameras were active once only. Nevertheless, they yielded a large amount of high-quality image products, many of them stereoscopic.

Only the far west of Austria has been covered by black and white Metric Camera Photographs. In Austria, three institutes, the Institute for Photogrammetry of the Technical University of Vienna and the Institute for Applied Geodesy and Photogrammetry of the Technical University of Graz together with the Institute for Image Processing and Computer Graphics in Graz, used MC space imagery within ESA research projects. Whereas the latter two institutes worked on geoscientific and land use applications in Asia, the Vienna Photogrammetry Institute produced an internationally noted orthophoto map and a corresponding stereo-mate, covering the 1:200 000 map sheet 47/10 Glurns (JANSA & KRAUS 1986).

Up to now, LFC photographs of Austria only cover the west of Vorarlberg (Raetikon and Rhein Valley), an area, incidentally just visible in a cloudless hole of a bad weather scene. No studies have been carried out with these data yet. In future, commercially available spaceborne radar data, like those of the European Remote Sensing Satellite ERS-1 - which can be acquired almost completely independent of meteorological conditions - will become increasingly important. The Institute for Image Processing and Computer Graphics in Graz is involved in the preparation of the data processing activities of ESA for the anticipated radar data in order to be able to provide immediately applicable image products for the prospective users (BUCHROITHNER et al. 1987, RAGGAM, STROBL & TRIEBNIG 1986).

3. RESOLUTION ASPECTS

The combination of different remote sensing data sets and/or the information extracted from them with existing map data is a prerequisite for an optimum solution of regional planning concerns. The only appropriate tool to achieve this in the digital domain is a spatial data system (LIS, GIS). Worldwide, such systems are being developed, and symposia are devoted to the integration of remote sensing data into GISs. An attempt in summarizing the requirements and possibilities of land information systems in Austria (in an initial phase) was published in a proceedings volume by GERSTBACH in 1986.

An indispensable data set within such a system is the three-dimensional topographic information. A digital terrain model (DTM) is an essential element in any GIS. Calculating slope gradients and aspects using a DTM is absolutely necessary for many planning activities (HAFNER & RAETZSCH 1985). Especially for (high) mountain regions a terrain model helps enormously. It can also assist in considering the terrain effect on different types of remote sensing data (BUCHROITHNER 1987b). For the meaningful application of digital radar data it is an absolutely indispensable requirement (BUCHROITHNER & TRIEBNIG 1986).

Table 1 Resolution requirements for remote sensing data applied in regional planning (based on European conditions, with special reference to Austria)
(IR = Infrared, w = wide spectral band width, s = small spectral band width)

	Useful Minimum Resolution				
	Geometric (meters)	Spectral			Temporal (years)
		Visible	Near IR	Thermal IR	
LAND USE CATEGORIES					
Settlements	10-40 (possibly stereo)	w	-	s	1 - 5
Open settled Areas	10 - 40	+	s	-	1 - 5
Agricultural Land	20 - 80	+	s	-	1 - 5
Barren Land	10 - 80	+	s	-	1 - 5
Water	10 - 90	+	+	s/w	monthly - 0,5
LAND COVER "PARCELS"					
Houses	10 - 20 (possibly stereo)	w	-	s	1 - 5
Roads	5 - 10	w	-	-	1 - 5
Railroads	5 - 10	w	-	-	1 - 5
Dumps	5 - 80	+	s	-	monthly - 1
Open Pit Mines	10 - 40	+	s	-	monthly - 1
Agricultural Fields	10 - 80	+	s	-	monthly - 1
Orchards	22- 40	+	s	-	monthly (dur.veget. period) - 3
Grassland	10 - 80	+	s	-	2-monthly (dur.veget. period) - 3
Forests	2 - 80	+	s	-	1-5 (dur.veget. period)

It was already, implicitely, mentioned above that for regional planning the relationship between required scale and spatial resolution of remote sensing data plays a prominent role. But apart from pixel size, spectral resolution and availability of new data for time series analyses are of great importance. In *Table 1*, an attempt is made to give an account of the spatial, spectral and temporal resolution requirements for various land cover types.

Table 1 shows that for many factors a spatial resolution of 10 m or less would be desirable. This requirement is presently only met by SPOT in the panchromatic mode and by the Metric as well as the Large Format Camera. The 30-meter resolution of Landsat TM data yields sufficiently accurate results for planning purposes, however, at scales of 1:100 000 and even beyond (cf. section 4).

It is self-evident that the geometric resolution factor also has significant impact on the determination of acreages of various surface units. *Table 2* gives an interesting series of figures on area calculation accuracies based on tests in an urban/rural area of 168 km². The size of the land cover parcels may also be considered representative for most parts of Austria.

Table 2 Accuracies of area calculations of small (0.35-4.0 ha), medium (4.1-16.0 ha) and large (16.1-270ha) land cover parcels in relation to spatial resolution and to CPU time reflecting the cost factor

Land Cover Parcel	Resolution Level (m)					
	10	20	30	40	60	80
Small	89.79	74.56	63.13	55.67	36.47	35.76
Medium	94.72	90.50	86.18	85.74	83.36	72.15
Large	97.27	97.09	95.33	94.47	94.86	92.13
Overall	93.99	87.58	81.82	78.94	72.03	67.18
CPU Time Ratios	61.92	15.57	6.89	3.93	1.74	1.00

4. REMOTE SENSING APPLICATIONS IN AUSTRIA

Shortly after their foundation in 1980 the Department for Satellite Cartography of the Austrian Academy of Sciences in Vienna and the Institute for Image Processing and Computer Graphics in Graz began studies on classification methods of multispectral

Landsat MSS data. Within a special project, research into the utilization of these data for Austria and the application of digital Landsat imagery was carried out. Based on two test areas, one in the urban area of Graz and its surroundings and one in the rural region of southern Styria, various - including multi-temporal - classification methods were tested with respect to their relevance for the acquisition of spatial information.
In the study mentioned above, LEBERL, RAGGAM & RANZINGER 1983 point out that an efficient application of satellite data in Austria is only possible with data of better spatial resolution (i.e. Landsat TM or SPOT HRV) except of global investigations like the estimation of the spring snow cover.

The first digitally corrected Landsat image map of Austria was published in 1983. As a base map for an atlas volume of the Austrian MaB project "Hohe Tauern", MSS data were used to produce the "Satellitenbildkarte Hohe Tauern" at a scale of 1:200 000. Despite a considerable loss of information this map, in the "classical" red version, still displays a lot of synoptic information. An article on map production and map contents was published by BUCHROITHNER (1983 a).

A first land use classification map based on Landsat MSS data at a scale of 1:100 000 was produced for the local authorities of Linz. It comprises ten land-use categories. The map was published in volume 7 of the "Linzer Atlas" together with a false colour map 1:100 000 and explanatory notes (BUCHROITHNER 1983 b) and yielded a very positive response which led to a revised reprint (BUCHROITHNER 1983 c). The accuracy of this classification amounts to 75% or more and reaches even 95% for the water classes.

As a consequence of the publications mentioned above, two 1:200 000 sheets of a satellite image map corresponding to the topographic 1:200 000 sheets Linz and Glurns were published by the Austrian Academy of Sciences. These maps, each representing mosaics of Landsat MSS late summer data, drastically show the advantage of synoptic depiction and allow for the mapping of the spatial units in an excellent way. Comprehensive information on the production of these two and the above mentioned maps is given in a monography by BUCHROITHNER (1987 c).

An application which is of considerable significance for regional planning with respect to construction engineering activities is the mapping of geological lineaments. This caused the Austrian Geological Survey to publish a map of Landsat image lineaments of Austria at a scale of 1:500 000 (BUCHROITHNER 1984 a). It was published together with comprehensive explanatory notes (BUCHROITHNER 1984 b).

The high correlation between lineaments mapped from satellite imagery and the areas of mass movements was explicitly stated and checked in the field by BUCHROITHNER and SCHÄFFER (SCHÄFFER 1983) in the area of the 1:50 000 map sheet of Gmunden. Presently several investigations, accompanied by detailed field checks, are carried out by the Austrian Geological Survey and will be published in due time.

The first digital utilization of Landsat TM data was made at the Institute for Image Processing and Computer Graphics in Graz on a scene of the world-famous skiing resort Schladming. Not only a land-use classification but also a superposition of the

TM data over a digital terrain model and a presentation in the form of an oblique aerial view of the area was prepared (BUCHROITHNER 1987 a).

A study into the application of Landsat TM data showed the usability of these data for the production of forest maps. In the "Grazer Bergland" west of the city of Graz various forest types were classified on two classification levels. Not only deciduous and coniferous forests as well as two types of mixed forests were distinguished, but also individual tree species, for beeches and birches even two age classes. The second classification level, however, requires rather homogenous stands within the TM pixels. The classification accuracy (which was checked in the field with representatives of the local forest authorities) amounts to some 91% (XU 1986).

Another application of (initially Landsat MSS and now multitemporal) TM data is the identification of geogenous and anthropogenous heavy metal stress in vegetation canopies in the previsual stage. These detailed investigations, which are partly carried out in close cooperation with the U.S. space agency NASA, cover test areas north of Graz and west of Eisenkappel in Carinthia. They are based on significant correlations between the heavy metal contents in the soil, wood, needles or leaves and anomalies in the near infrared. The methods developed (BANNINGER 1986 a, b) will, in future, permit an early mapping of forest decline.

Beside the production of a geometrically rectified Landsat TM map covering the Ötztal and Stubaital Alps which will be used for glacier and snow studies at the University of Innsbruck, in 1986 these satellite data were, for the first time in Austria, applied for super-regional planning purposes. Through the initiative of the Institute for Image Processing and Computer Graphics and by order of the Styrian Government a green version of a satellite image map of the whole federal province of Styria at a scale of 1:200 000 was prepared (BUCHROITHNER 1987 a). This map represents the base map of the Enviromental Information System of Styria (Landes-Umwelt-Informationssystem). The accuracy of this mosaic consisting of four individual TM scenes is so high that it is congruent with the respective map sheets of the Austrian Topographic Map 1:50 000. This allows an efficient use for planning concerns. Political boundaries, map signatures as well as written map information, legend and map margin were generated and engraved digitally. Thus, this map represents one of the very first precise and completely digitally stored satellite image maps in Austria.

Starting with two pilot projects, the production of land-use maps based on the above data has begun. These maps, which contain 15 landcover classes and which exist for the district of Leibnitz (south of the city of Graz) and the southern slopes of the Niedere Tauern Range for far, represent a first part of a land-use mapping project which eventually should cover the whole federal province of Styria.

As already mentioned in section 2, image data of the thermal sensor of the HCMM satellite have been available since 1978. Within the scope of regional planning activities typical fall data (September) of this type were used for a mesoclimatic study

in the area of the open pit mines of Köflach-Voitsberg in western Styria. The digital data were rectified to fit the geometry of the Topographic Map 1:200 000. Moreover, essential geographic features like political boundaries, rivers, major settlements and contour lines with 500 m equidistance were superimposed. The data were calibrated and colour-coded according to terrestrial temperature measurements. Beside the individual day and night images of the thermal day/night differences were also produced.

Night data for November were displayed in the same way. This allows for multitemporal evaluation. The various colour-coded image products combined with planimetric and topographic information were then handed to climatologists of the University of Graz for further research. The multitemporal data, to a certain extent, allow for a comparison and, thus, more definite statements on the regional climate (BUCHROITHNER 1987 a).

5. REMARKS ON ASPECTS OF ECONOMY

The range of applicability for remote sensing in general and for Austria in particular has already been shown in the previous sections, and there is no doubt that this technique will be increasingly used for regional planning in the future.

As a complement to the above statements it might be interesting to glimpse at the commercial side of spaceborne remote sensing. The data costs in Austrian Schillings (AS) per square kilometer are inversely proportional to the areas per scene. The figures given in *Table 3* must be taken as approximate values

Table 3 Data costs in AS per square kilometer

Landsat MSS	AS 0.35
Landsat TM	AS 1.75
SPOT MSS, panchrom	AS 5.00
Heat Capacity Mapping Mission	AS 0.006
Metric Camera	AS 0.03
Large Format Camera	AS 0.01
High Altitude Photo (not available for Austria)	AS 35.00

It is self-evident that these rather appealing figures have to be seen in the context of spatial resolutions and required working scales.

Finally, attention should be drawn to the last line of *Table 2* which also gives an indication on how computing costs increase with better geometric resolution. This information has to be considered when taking into consideration the figures given above. The optimum cost range for digital data treatment is in the range of 20- and 40-meter resolution.

On the whole, the factors of cost, time requirements and information content obviously recommend the application of remote sensing in regional planning.

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LOCATIONAL ASPECTS AND REMOTE SENSING IN FOREST DECLINE STUDIES: RESULTS OF A LOCAL PILOT STUDY IN CARINTHIA, AUSTRIA

by

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SUMMARY

Forest decline depending on ecological locational and spatial conditions is being introduced into the existing wide spectrum of international research into forest decline as a specifically geographical aspect. Relationships between observed damages and spatial parameters are especially clear with respect to distance factors, such as distance from sources of emissions, intensity of pollution and differences in elevation. There also is a correlation between the types of relief of the various locations and the damages, but this dependency is strongly influenced by other locational features, e.g. the location's being situated within or above the zone of inversion in winter. Within it, there often is a large amount of pollution such as in the study area "Lavanttal" (Carinthia), due to emissions of a thermal power station.

The extent of forest decline was studied by means of classifying the damage to be observed with individual trees by means of colour-infrared-airphotographs. This method is being described in detail.

The advantages of using remote sensing are discussed here. The present state of the art in forest decline research is presented in order to elucidate the relative position of a spatially oriented dependence analysis in the field of forest decline research.

ZUSAMMENFASSUNG

Als geographisch-raumwissenschaftlicher Aspekt wird die Abhängigkeit der Waldschäden von standortökologischen und räumlich-distanziellen Parametern in das derzeitige breite und internationale Forschungsgebiet der Waldschadensforschung eingebracht. Die Dependenzanalyse zwischen beobachteten Schäden und raumrelevanten Parametern gelingt insbesondere bei räumlich-distanziellen Merkmalen wie Distanz vom Emissionszentrum, Intensität der Schadstoffbelastung und Höhenstufung. Auch zwischen den Relieftypen der Standorte und

den Schäden wurden Zusammenhänge festgestellt, wenngleich diese Dependenzen stark von anderen Lagemerkmalen der untersuchten Standorte abhängig sind. Hier ist insbesondere die Lage innerhalb oder außerhalb der winterlichen Inversionsschicht von Bedeutung. Innerhalb der Inversionsschicht kommt es im Untersuchungsgebiet "Lavanttal", Kärnten, aufgrund der Emissionen eines thermischen Kraftwerkes zu besonderen Schadstoffbelastungen.

Die Ermittlung des Waldschadens erfolgte durch die Schadensklassifizierung von Einzelbäumen aus Color-Infrarot-Luftbildern. Das Verfahren der Schadensfeststellung wird beschrieben.

Die Vorteile des Einsatzes von Remote-Sensing-Verfahren werden diskutiert. Eine knappe Darstellung des Forschungsstandes ermöglicht die Einordnung der raumorientierten Dependenzanalyse in den Gesamtbereich der Waldschadensforschung.

* * *

1. MAIN ASPECTS OF FOREST DECLINE RESEARCH AND POSSIBLE CONTRIBUTIONS OF GEOGRAPHY

The problem of forest decline became obvious in the countries of Central Europe first, thus studies pertaining to it are mainly in German, and nowadays the term "Waldsterben" is being used in English-speaking countries, too. The spectrum of research is highly complex, but might be divided into three thematically independent but related fields:

1. Recording of forest decline as to its extent and spatial range.
2. Ecological-physiological studies of causes and effects.
3. Economic and political aspects of the problem of forest decline.

The recording of forest decline is being carried out within the framework of forest state inventories, by means of classifying the state of the crowns of individual trees visually. The results are being registered according to administrative or other spatial unist. Such inventories are carried out, often yearly, by various public agencies (e.g. in Baden-Württemberg: SCHÖPFER-HARADETZKY 1984; Bavaria: KENNEL-ZWIRGELMAIER 1985; Hessia; Carinthia, Slovenia: HOCEVAR 1986, Poland). Both terrestrial methods and photographic techniques of remote sensing are being applied.

Ecological-physiological research into causes and effects traditionally are the field of forestry and plant physiology (cf., for instance, LICHTENTHALER 1985, SCHÜTT 1984, BOSCH 1983, Arbeitskreis Chemische Industrie, 1983). Air pollutants are being regarded the basic causes for "recent" forest decline, being effective over long periods both via the leaves and the soil and, thus, the roots. The visible results consist in a premature shedding of leaves and a thinning out of the crowns due to a premature senescence of the leaf organs. In addition, a shortage of water and nutrients can aggrevate the problem temporarily and/or spatially, thus causing a retardation in growth (SCHWEINGRUBER 1985, ATHARI u. KRAMER 1983). Because of the economic consequences of forest decline, namely a premature killing of forests or the retardation of growth (KROTH

1986, RÖHLE 1985), it becomes an issue of forestry politics (NIESSLEIN 1983, 1986, STEINLIN 1985) and regional planning (STRUBELT and WENDLING 1985).

Spatial and locational aspects of both forest state studies as well as of research into the causes can be considered "geo-branches" of forestry. In these respects, geography can contribute important findings by means of methods of spatial analysis that have been used widely in social and economic geography, but also in geomorphology. The ecological evaluation of locations is carried out by geo-ecological research.

In this paper, chorological problems and problems of location ecology with respect to forest decline are being dealt with, and an attempt is made to clarify to what extent these spatial parameters can explain the observed distribution of forest damages. Traditional methods of spatial analysis are combined with methods for assessing the damages by means of remote sensing. The study of a sample area in the Austrian Alps presented here is meant to be a serviceable interdisciplinary effort in this field. It was financed by the Austrian Federal Ministry of Science and Research.

2. THE ASSESSMENT OF DAMAGES BY MEANS OF REMOTE SENSING

2.1. The assessment of forest damages by means of classifying the state of crowns. What tree is to be considered "damaged"?

No doubt the damages termed "recent forest decline" are due to air pollution caused by man (cf. KNABE 1985, LICHTENTHALER 1985, ULRICH 1984, SCHÖPFER and HRADETZKY 1984), but not all retardations in growth etc. are due to immissions. Other causes are unfavourable locational conditions, pests of plant diseas, physical damages due to human influences or natural hazards (cf. POLLANSCHÜTZ 1986). Only if none of these causes exist pollution can be blamed. On the other hand reduced vitality is not equal to "damages" in all cases, it might be seasonal only and growth might not be impaired. Therefore forestry prefers the rather neutral term of "state of the crown" when classifying individual trees. The terms "forest decline" or "reduced vitality" are only used when proof is found for actual damages caused by specific agents. "Waldsterben" is a term rarely used in research literature.

Methods for assessing and evaluating the state of endangered forests have been standardized to a large extent, in the German-speaking countries at least. Damages are classified according to the state of the crowns of individual trees as visible directly or via an air-photography. 4 stages are being distinguished. For firs (Picea abies), they are defined in Austria in the following way (simplified version):

state of the crown	state of the tree
1) no or little loss of needles	sound

2) loss of up to 25% of the needles	reduction of vitality not significant, might be caused by various influences (natural ones, too) recovery within 2 or 3 years possible
state of the crown	state of the tree
3) loss of 25 to 60% of the needles, crown clearly "transparent"	significant damage
4) loss of over 60% of the needles, no proper crowns, including dead trees	severe damage, tree normally dying or already dead

When the study is carried out from the ground, a sample of 30 trees per stand is classified according to this scheme. The weighted mean per stand constitutes the "crown state index" ("vitality index") and describes the extent of damages. This method is quite useful for studies to be repeated each year as a basis for describing the process of forest decline. There usually is a 4 by 4 km grid providing a sufficient number of sample points for larger areas. For studies at medium scales this grid is too wide-meshed, though. This is especially true in connection with locational or spatial (distance) parameters and more complex types of landscapes, as in the mountainous areas in Austria.

2.2. Remote sensing in research into forest decline

If the state of a large number of crowns is to be assessed quickly and almost simultaneously, methods of remote sensing are useful. The choice of a specific method is based on two parameters, namely the spectral and the spatial resolution as to the data. If it is to complement and augment studies made on the ground, it must be possible to classify the crowns according to the four stages mentioned above. A loss of needles or other damages of the crown must be clearly visible, so that the individual tree can be desdribed in detail. Only if these requirements are met this method will be accepted as useful by forestry and be applied in practice.

As a high degree of spatial resolution is necessary, only photographical methods can be used. With scanner methods, the pixels, at best, comprise several square metres, therefore their spatial information is unfit for use in this case.

With respect to spectral quality, colour infrared films are being used worldwide, as they are well suited for assessing a reduction of vitality. In the wavelength range of the near infrared, sound vegetation reflects sunlight most strongly, and reflexion weakens with reduced vitality. On a CIR-film, sound vegetation appears, depending on the tree species, brilliantly red to dark purple, with damages the colours are paler and change to pink and bluish-green. For studying the crowns stereo pairs at a scale of not less than 1:8000 are necessary.

Infrared films were first used in forest inventory-taking (HENNINGER and HILDEBRANDT 1980), later on in forest damage research (KENNEWEG 1980, SCHWARZENBACH and OESTER 1986), too.

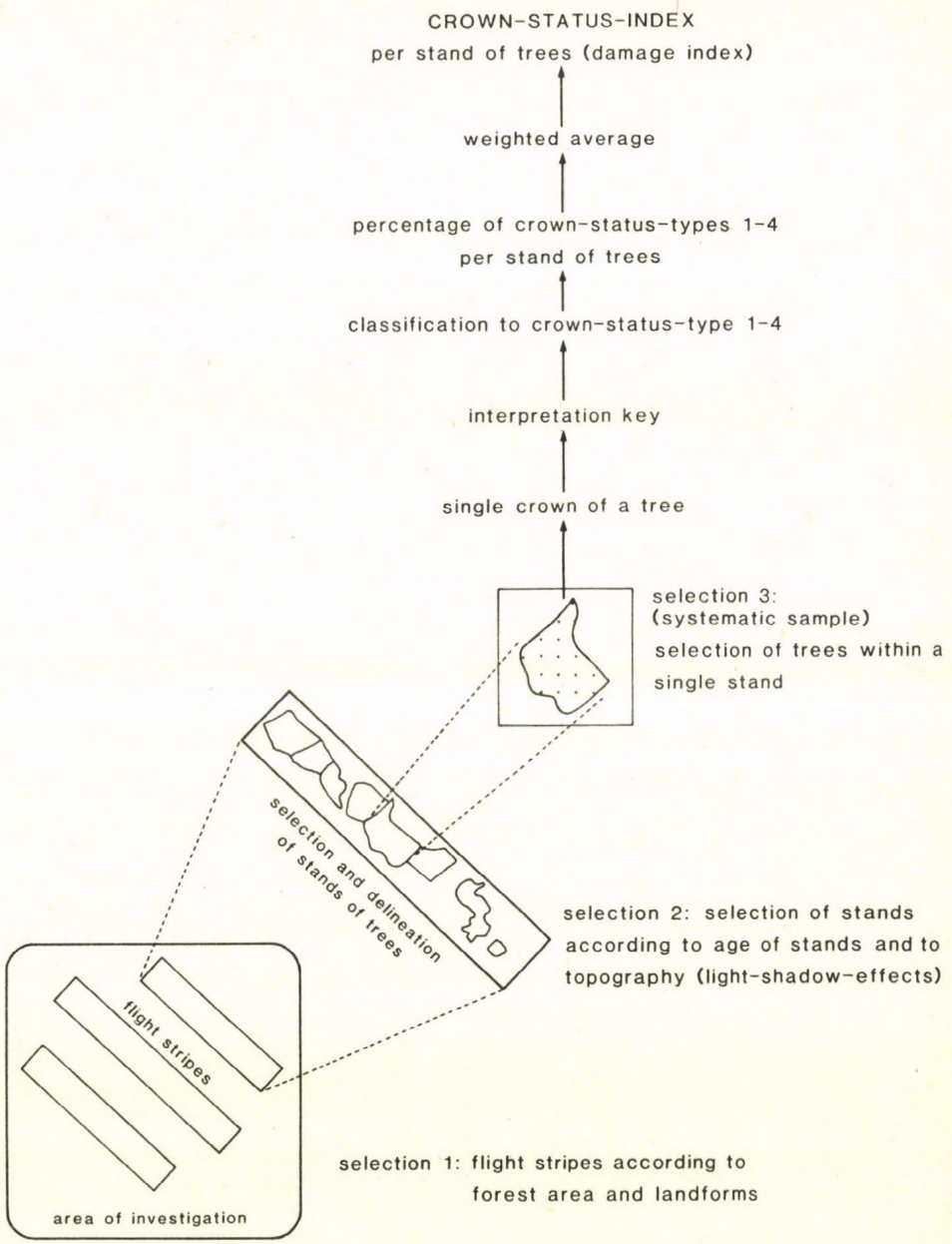

Fig. 1 Steps in acquiring data for assessing forest damages by means of air photos

S: choice of study area, flight plan, flight	P: optimal planning of flights, compromise between sufficiently large scale and low costs with respect to goals; choice of appropriate lens system, weather problems
R: series of quality CIR-photos with high resolution	
S: choice of stands and delimitation on the CIR-photo	P: criteria for interpretation (age of the trees, size of the crowns) and homogeneity (of stands and of locations); sufficiently large number of stands for statistical projection
R: homogenous stands, interpretable units	
S: selection of a sample of trees to be studied	P: random sample in each stand: methods of drawing sample, problems of representativeness
R: individual trees as spatial sample within each stand	
S: interpretation: classification of individual trees (vitality status: 1 - 4)	P: key for the interpretation, trained personnel, verification on the ground, comparison with vitality stages of WZI, data organization
R: frequency of vitality status 1 - 4 for different species in the sample (number, percentage)	
S: calculation of vitality index for the stand	P: vitality index as weighted mean, other parameters feasible, information loss with just one parameter
R: parameter describing the vitality status of a stand	
S: representation of the vitality status of the forests in the study area	P: map depicting vitality classes: problems of class boundaries, cartographic problems
R: statistics - diagrams - maps and their interpretation	

assessment of forest status by CIR-remote sensing finished; results show status quo and can be entered into further analyses

Further analyses: research into the relationships between the status quo of the stands and ecological (atmospheric / edaphic / biotic) parameters.

Source: SEGER 1986

Fig. 2 Steps in assessing the status of forests by means of remote sensing with colour infrared films
S = step; R = results; P = problems to be considered

The state of the art is also described in a textbook already (HUSS 1984). Several studies on forest damages using IR-films have been carried out Austria as well (ZIRM et al. 1985, POLLANSCHÜTZ 1986, FIBICH et al. 1986, SEGER 1986).

2.3. The assessment of forest damages by interpreting CIR-photographs in the "Lavanttal" study area

The study area is an inneralpine valley in the southeastern Alps in Carinthia. The valley is situated at an altitude of 600 m, the neighbouring mountains are up to 2100 m high. The area has been known to suffer from smoke damages for a long time. They have been caused by the emissions of a thermal power station burning lignite. The firm pays damages to the owners of the forests.

The area being 20 by 20 km, costs would have been too high for a complete coverage by air-photographs, therefore only a sample of tracts was drawn. Within these, covered by 400 air-photographs, 1700 homogenous stands were chosen. Crowns can be distinguished only with trees that are more than 60 years old, and only with such stands an interpretation is possible. Within the stands, a systematic sample of individual trees was drawn, comprising 30 to 60 trees each, giving a total of about 12 000. These trees were classified according to the stages described above. For each stand, the vitality index was calculated.

Figures 1 and *2* depict the steps of the study from the flight to the calculating of the vitality index schematically and more systematically. Expert photo interpretation is central to this method, as only thus the validity of the classification is ensured. A special training and repeated field studies appear to be necessary, and the criteria for the classification must be clearly defined (cf. HARTMANN 1983, MASUMY 1984, etc.) and adapted for each flight because of colour variations.

2.4. Methods of representing the results of forest decline studies

The CIR-photo interpretation provides data for the state of each stand: the proportions of the four "crown state stages" and the vitality index. Moreover the spatial distribution of the various states is given. An example is presented in *Figure 3:* The polygons form the boundaries of homogenous stands, contour lines help towards visualizing the relief.

With just giving one parameter per stand, that is, moreover, classified as in Figure 3, some of the information provided by the air-photograph interpretation is lost. A diagram like *Figure 4* shows the distribution of the vitality indices and the proportions of the 4 "crown state stages" for each stand. The latter have a typical pattern: Even in sound stands there are a number of impaired trees, and heavily impaired stands contain trees with stages 1 or 2 of the crown state. When dividing the stands into groups along the X-axis, classes can be formed according to the vitality index, but the spatial location of the stands is not representable.

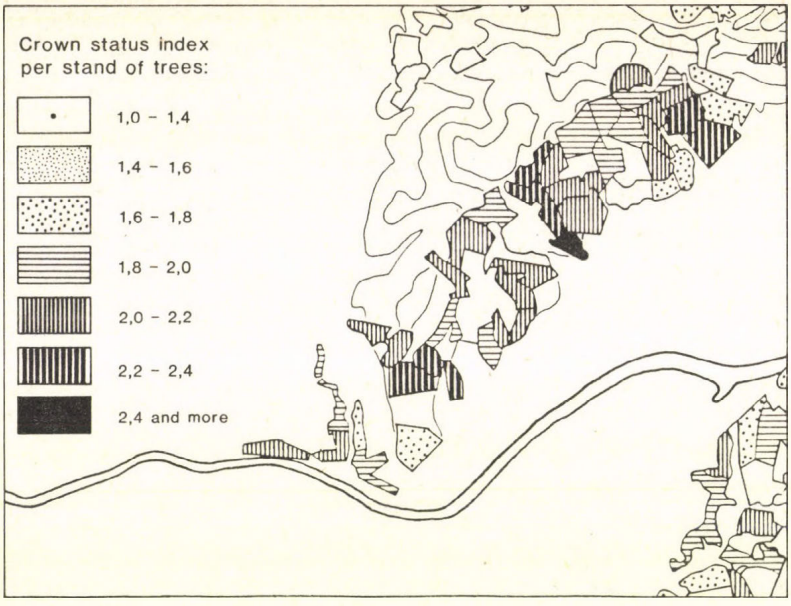

Fig. 3 The state of individual stands in a series of air photos. Results of a classification according to the state of the crowns

In *Figure 5*, the situation of two subregions of the study area (A: eastern slopes, B: western slopes) is depicted. It clearly shows that the situation is more favourable with B: The proportions of stage 1 and 2 are markedly larger.

In a similar way differences between species can be represented *(Figure 6)*. Firs obviously are most strongly impaired, beeches least.

When considering the topographical distribution of the classes of the vitality index, a few relationships with the terrain became obvious: In general, e.g., the extent of damages decreases with height. Other results are presented below.

3. FOREST DECLINE AND LOCATION: RESULTS OF AN ENQUIRY INTO CAUSES

3.1. Spatial and locational parameters

Statistical enquiries into causes and effects in connection with forest decline normally are based on eco-physiological aspects mainly. Very few studies deal with topographical and locational problems (e.g. Bayrische Forstliche Versuchs- und Forschungsanstalt: TRÄNKER 1983, 1985; MÖSSMER 1986). The present author holds that a study forest decline combining

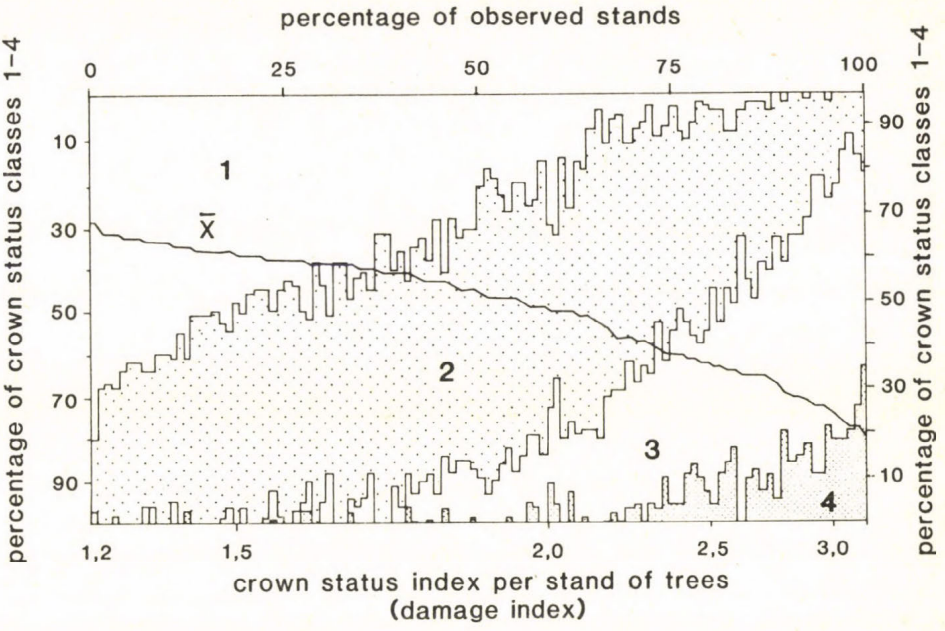

Fig. 4 The state of the forests in the study area (rank diagram with x = vitality index)

these aspects is to be considered a valuable contribution geography can offer. Therefore locational parameters are being introduced once the intensity of damages as such has been assessed, and their interdependence is being studied. There are three sets of parameters being used to describe a location that are more or less independent of each other, but may show some correlations:

- parameters describing the terrain,
- parameters of distance and direction,
- parameters describing ecological aspects.

In narrower sense, locational factors can be described by edaphic and regional climatic parameters, with the latter including pollutants and local variations in climate. Terrain parameters describe the location as to its altitude, exposure and inclination. In addition to these straightforward terrain parameters there are "relative" ones denoting the distance from, or the direction towards, known sources of pollution and a position on the lee side or windward side of them. Those of these parameters that have been used in the "Lavanttal" study are represented schematically in *Figure 6*, though individually only and without showing their connections with each other. Both their different values and their interplay give

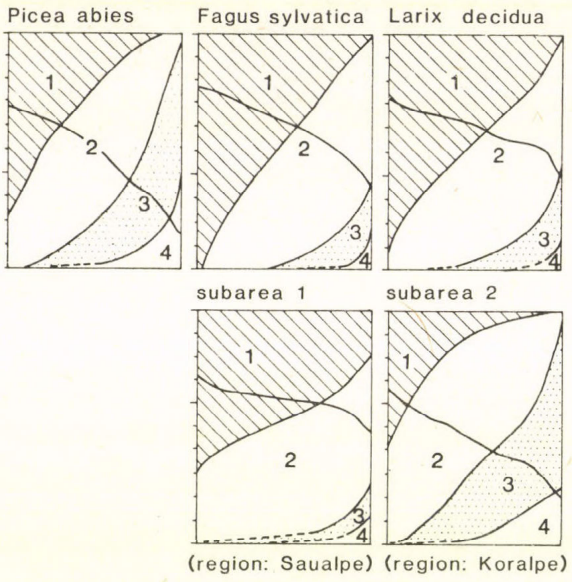

Fig. 5 The state of various species and of subregions of the study area

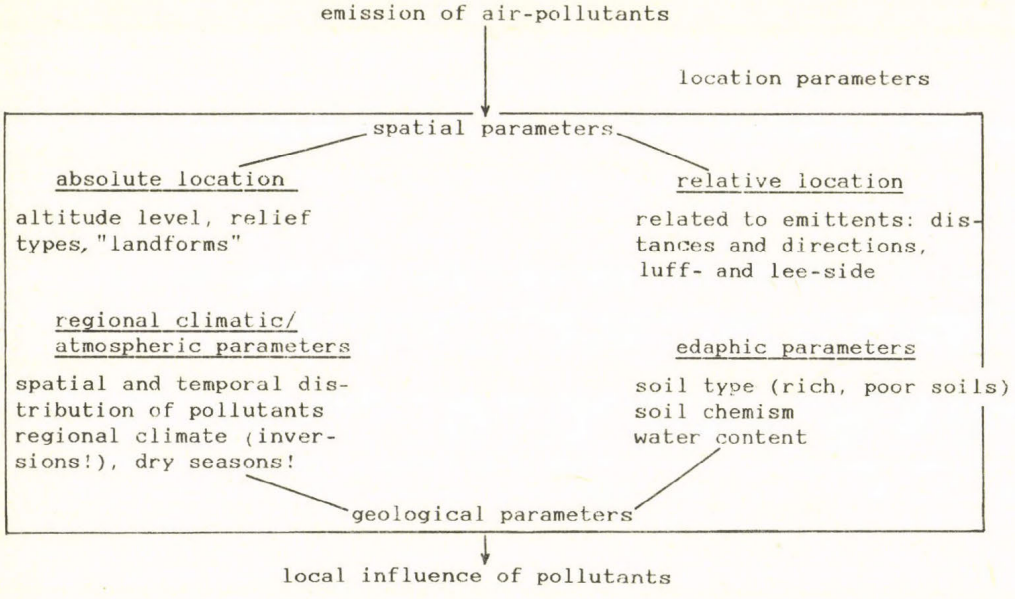

Fig. 6 Location parameters as variables of the effect of air-pollution

an indication of the varying effects of pollutants on the different types of locations. An attempt is made to find out whether differences between the parameters listed below parallel differences in the extent of forest decline:

Location in space: altitude zone, type of relief, exposure, inclination.
Relative location: distance from, and direction towards, local sources of pollutants, lee side or windward side with respect to these.
Atmospheric parameters: air pollution by SO_2, precipitation and temperature.
Edaphic parameters: soil type.

Both the atmospheric and edaphic parameters have been used in evaluating locations by forestry long since and are being considered in terrestrial inventory-taking with respect to forest decline (POLLANSCHÜTZ 1985), but there are no correlation analyses existing yet.

3.2. *An outline of the causes and effects of forest decline in forest ecosystems*

An outline of the wide spectrum of possible causes for forest decline ought to be presented so that the various effects can be related to them correctly. It should be stressed that the assessment of the state of the crown is just one of the many ways feasible for evaluating the extent of damages.

Figure 7 attempts to present a general and holistic model of agents and their effects in a forest ecosystem with respect to forest decline. In connection with the effects of air pollutants it is shown which parameters were included in this study and what effects, similarily, could be caused by other agents. Five different agents that might influence damages or even cause them are being discussed:

ad 1: Location: The set of parameters as to location were discussed in chapter 3.1. The term of "regional movements of air masses" used in *Figure 7* points to the fact that there is temperature inversion in the study area in winter and that there is a vertical zoning as to air pollution. As the study showed, there is no danger of a high concentration of SO_2 and NO_x from distant sources in the higher altitude zones.

ad 2: Effects of pollutants on the trees: The assessment of the state of the crowns according to the method described in chapter 2 is independent of airpollution that could not have been measured anyway. If a detailed enquiry is made into the causes of the impairment these aspects of pollution, climate and ecophysiology gain weight quickly.

ad 3: Parameters connected with the vegetation: The various species of trees show variations as to the impairment by pollutants, and the age of the trees also influences their relative sensitivity. Therefore, these two aspects were introduced into the study as variables. There was no possibility to study plant physiological problems, such as variations as to the intensity

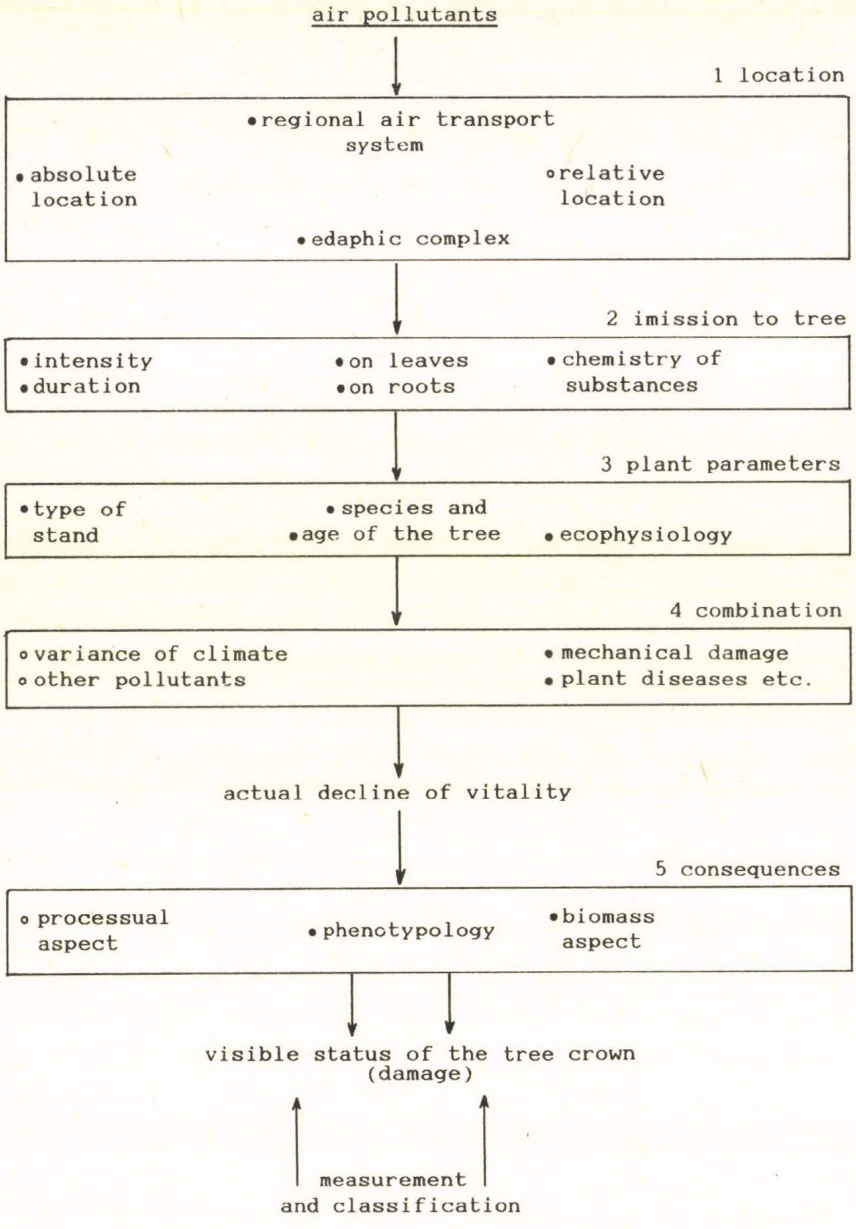

Fig. 7 A holistic scheme of parameters and aspects within the ecosystems approach of forest decline

of biochemical reactions in the different altitudinal zones and with varying climatic conditions.

ad 4: Additional impairment by other damaging agents, such as mechanical damages caused by natural hazards or done by game as well as plant diseases, is of no importance in the study area. There also are no anthropogenic damages caused by wood-cutting and transport. It was not possible to assess the relative importance of specific types of forest culture (intensive forestry, extensive forestry, forest pasture) as well as that of other air pollutants, especially of ozone (KRAPFENBAUER 1986).

The variations in climate whose importance tends to be overlooked often were studied in some detail. When comparing the summer means of temperature and precipitation for a number of years (cf. *Figure 8*), the period of 1982-1984, and especially the summer of 1983, strikes as markedly too warm and too dry.

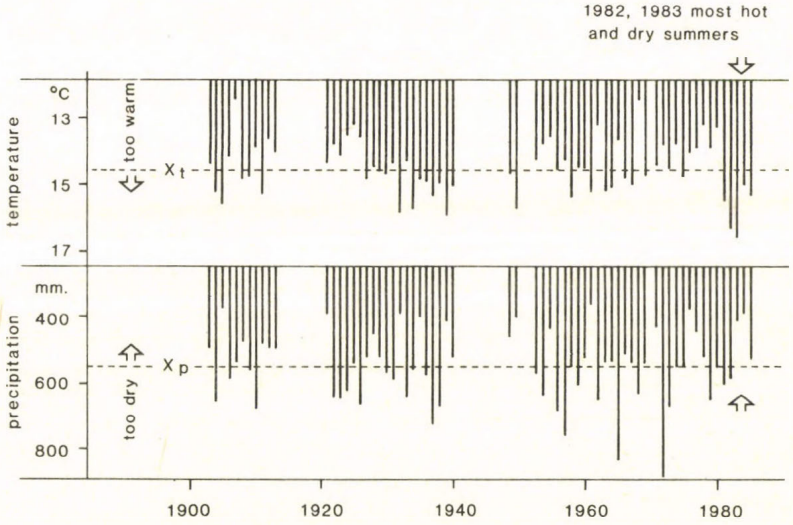

Fig. 8 Climatic variations in the summer halfyears of 1901-1984 (weather station Wolfsberg/Lavanttal)

The physiological reaction to a considerable lack of water consists in a reduction of the number of transpiration organs by shedding needles or leaves. The enormous increase in damages during this period certainly is due to these climatic anomalies to some extent.

ad 5: The effects of damaging agents: The combined effects of various damaging agents bring about the present state of the forests that can be assessed and classified by CIR-film interpretation. Neither the process of forest decline nor the reduction in growth can be recorded by studying the state of the crowns. Time series studies and research into growth (POLLANSCHÜTZ 1986) can provide information on these aspects.

Consequently, the enquiry into the causes and effects of forest decline in the "Lavanttal" is based on the following data:

There are satisfactory data on
- differences between the stands as to the proportion of specific species and as to tree age,
- impairment of specific locations through SO_2,
- the description of specific locations by means of locational ecological parameters (but for the local water balance). At the time of the flights there definitely was no noticeable impairment through mechanical damages or plant diseases.

No data were available as to
- the local water balance and the supply of nutrients as well as the pH-values and their variations in the soils of the various stands,
- air pollutants (but for SO_2).

Moreover the effects of climatic conditions on the eco-physiology of the forests in the different locations is unknown.

3.3. The interdependence between the state of the forest and locational parameters and a cluster analytical classification of stands

Already the CIR-film interpretation *had shown that the state* of the forests clearly improved with height. This trend is obvious in *Figure 9* that is representing the average state of the crowns in the various altitudinal zones. Apart from that the curve characterizing the amount of damages has a curious form: Impairment is considerably higher everywhere from the valley floor to a height of about 1000 m, above that there is a marked improvement up to about 1500 m. The upper limit of heavy damage corresponds to that of temperature inversion in winter (cf. SEGER 1986). Below there is a higher concentration of air pollutants, especially of SO_2. While carrying out the study described here it was possible to draw up characteristic height profiles of SO_2 pollution (SEGER 1986). Above 1500 m, the vitality index reaches higher values again. To some extent this might be due to a fairly old age of the trees near the tree line. Some authors hold that an influence of ozone from upper layers of the atmosphere might cause this.

The concentration of SO_2 was measured at about 50 stations during the winters of 1977, 1978 and 1984. In pollution zone 7 it was higher than 18 mg/28 d*100 cm^2 with respect to a standardized PbO_2 layer, and below 3 mg/28 d*100 cm^2 in zone 1 that is situated around 1600 m. There clearly is a positive correlation between less damage and lower concentrations of air pollution *(Figure 10)*, but most heavily impaired tree stands

Fig. 9.

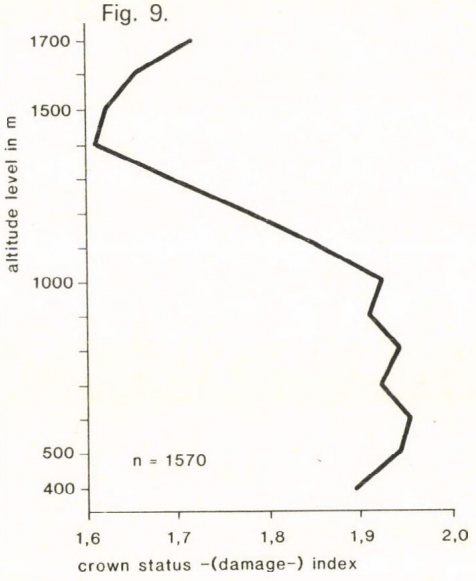

Fig. 10.

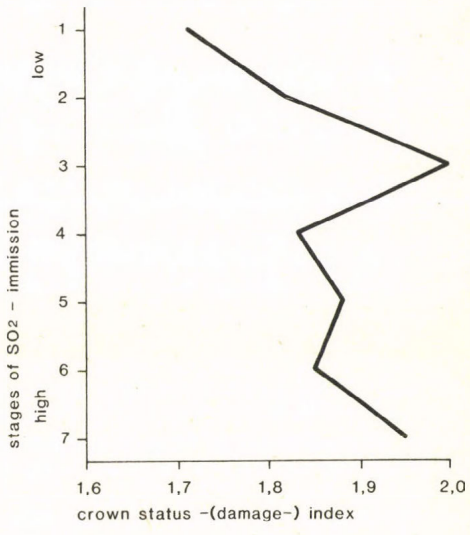

Fig. 11.

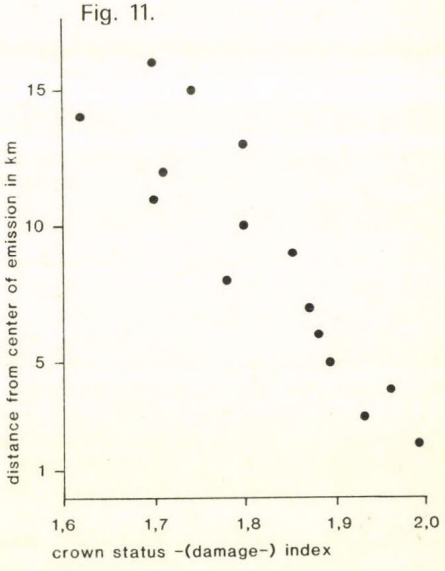

Fig. 9 Forest damages and altitudinal zones

Fig. 10 Forest damages and SO_2 concentration

Fig. 11 Forest damages and distances from a source of emissions

coincide with medium concentrations. This might be explained by the fact that zone 3 (9-12 mg SO_2/28 d*100 cm^2) is mostly found on slopes at a height of 600 to 800 m that are impaired by extremely high concentrations of air pollutants emitted from high chimneys, for short periods only though, that obviously are highly detrimental to forest vitality.

Distances from sources of air pollution are variables closely connected with the zones of similar SO_2 concentration, and especially so in the study area, as there is just one such source that is, moreover, situated right in the centre. As is shown by *Figure 11* there actually is an almost linear negative relationship between damages and distances. A wider spread of the values at distances over 10 km might be due to pollution stemming from neighbouring areas.

On the whole, there is a gradient as to the extent of forest decline from the centre to the periphery, modified, though, by the influence of local inversions. Therefore the cause of the damages is to be considered an autochthonous one.

The question ought to be raised whether different types of terrain influence the extent of the damages. It can be assumed that ridges and rounded hilltops are much more exposed to air currents, whereas more sheltered locations ought to show less damage. This nexus becomes obvious only after dividing the study area into three altitudinal zones (cf. *Figure 12*), but clearly shows the importance of studying the relief in connection with the exposure to air currents and, thus, pollution when assessing the extent of forest decline.

For this reason, slopes directly exposed to such air currents and similar locations were compared with areas on the lee side (cf. *Figure 13*). While there is no difference in the lowest altitudinal zone - a fact that might be attributed to a similar impairment of different locations due to the effects of the inversion -, a larger extent of damages clearly coincides with an exposure to air currents higher up. While soil types show no significant correlation at all, the other locational variables tested contribute little to an explanation of the situation observed.

Control areas outside the study area that are also sheltered from air containing pollutants showed a similar extent of impairment up to 1200 m because of local sources of emissions existing there as well, but the highest altitudinal storey is markedly sounder than that in the "Lavanttal".

Consequently it should be stressed that the distance from a source of pollutants, the height above sealevel and the types of terrain are those of the locational variables that explain a significant proportion of the spatial variation in forest damages.

So far, interrelation were only represented by means of frequencies or in two-dimensional diagrams. A classification of forest stands using multivariate techniques seems to suggest itself, too, therefore a cluster analysis was carried out. Naturally only metric variables could be included into it, namely the vitality index, the SO_2 concentration and the altitudinal zones. An optimal classification of the individual stands was possible with a 9 clusters' solution. It is represented in *Figure 14*, with the position of the individual clus-

ters in the three-dimensional variable space denoted by solids situatued around the centre of the respective cluster, with the lengths of the edges corresponding to two standard deviations, thus comprising 66% of the individual cases. These solids do not overlap, though the spaces taken up by the rest of the cases do, especially so with clusters 6 to 9 that correspond to the area of marked impairment through SO_2 at a height of 400 to 1000 m, that is below the upper limit of the inversion. Clusters 4 and 5 have the advantage of large distance from

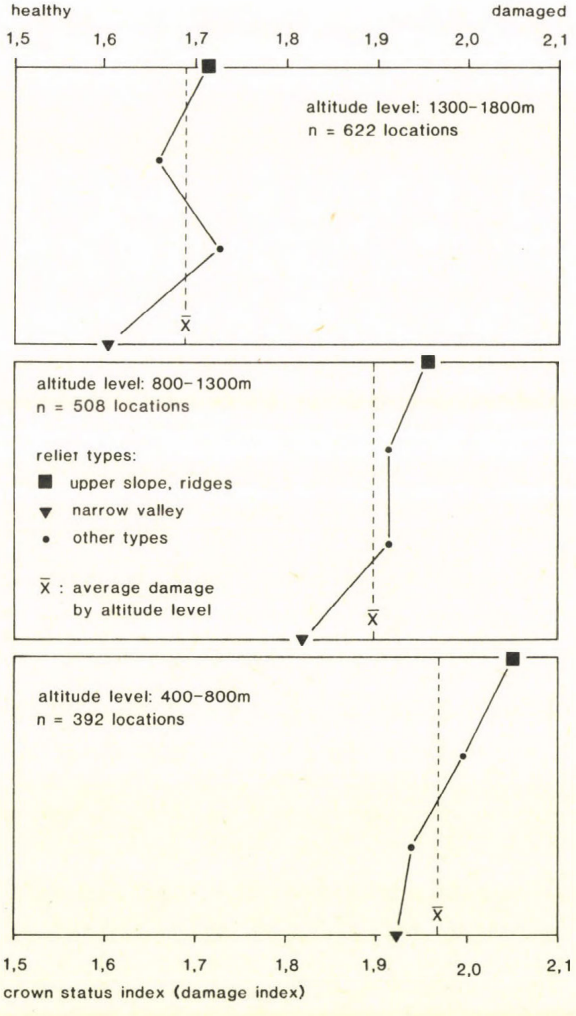

Fig. 12 The relationship between forest damages and types of terrain at individual locations

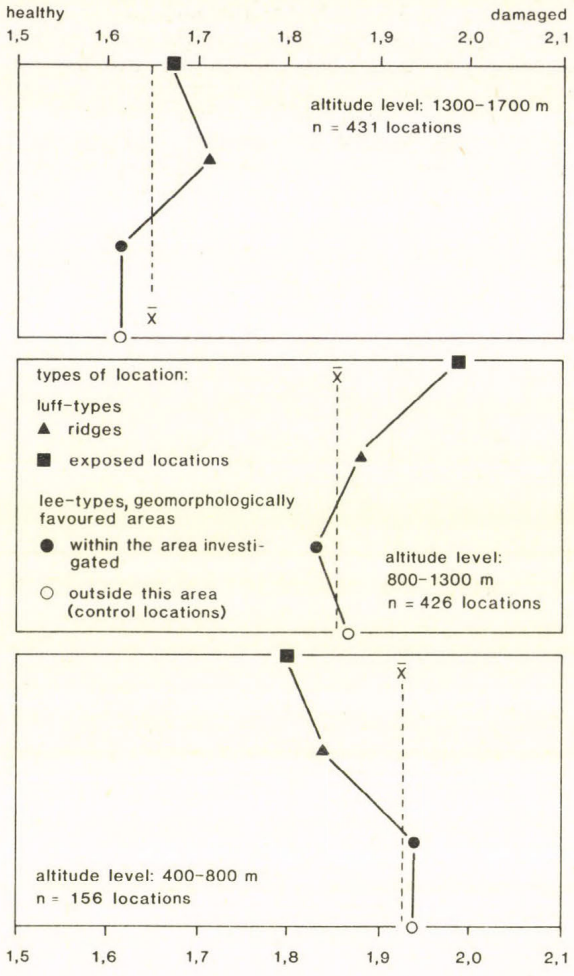

Fig. 13 The relationship between forest damages and a location on the the leeside or windwoard side of a known source of emmissions

the source of pollution, but still show some damage, whereas cluster 3 has an intermediate position between them and clusters 1 and 2 that comprise fairly sound stands at a height of above 1300 m.
This analysis provides the basis for conservative inferences as to the extent of forest decline in areas of similar structure outside the study area proper.

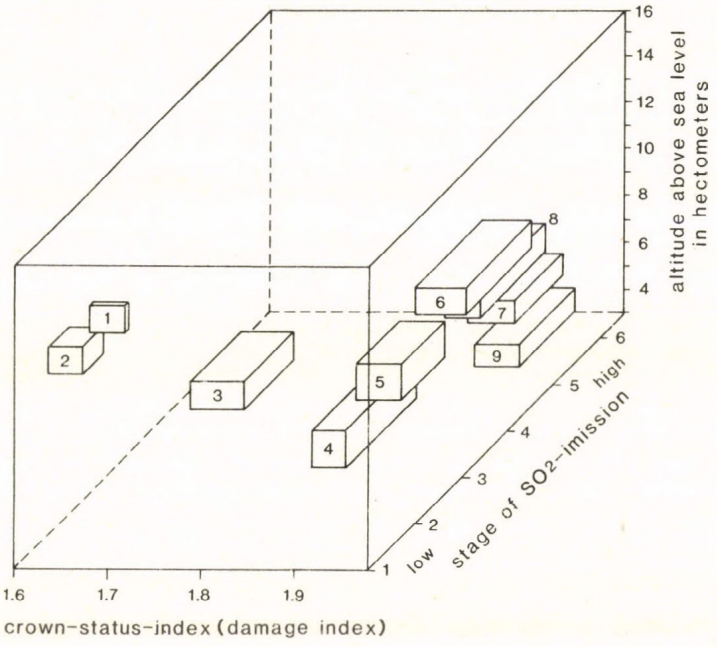

Fig. 14 A typology of stages in forest decline by means of cluster analysis

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AGROECOLOGICAL MICROREGIONALIZATION IN HUNGARY

by

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SUMMARY

The method of agro-ecological micro-regionalization was developed by the research-team of the Department of Physical Geography in the Geographical Research Institute of the Hungarian Academy of Sciences, under the direction of László GÖCZÁN, in 1983. The method is perfectly suitable for establishing to what extent existing agro-ecological potentials are convenient for the cultivation of important agricultural plants.

The data were processed by means of a Commodore-64 micro-computer. First of all the computer-assisted evaluation process was applied for the area of Komárom county, then in the Igmánd-Kisbér basin, that is first for an administrative unit, then for a physio-geographical micro-region. The classificiation was carried out on a 1 to 10 scale for each of the 21 chosen variables, namely: (1) relief, (2)-(9) general climatic conditions, (10)-(12) precipitation data, (13)-(16) data as to vegetation-specific total precipitation, (17)-(21) pedological potentials.

By perusing specialized agrarian literature it was possible to establish the conditions as to the physio-geographical factors favourable for, or restricting the production of specific plants. The program compared these "suitability indices" with code numbers representing environmental conditions, evaluating the 25 hectare areal units by means of an additive method.

Accordingly, six maps were produced giving an evaluation as to the suitability of the areal units for different plants, namely wheat, maize, sunflowers, sugar-beet, lucerne and vine, in the form of a thematic map with a code-number for each areal unit. Besides the maximum values were represented in a map.

The map of Komárom county and the map of the micro-region's habitat types are the basis for an agro-ecological micro-regionalization. The map depicts which plants or groups of plant got the relatively highest score on each the given 25 hectare units, symbolized by a specific colour. From the legend of the habitat-type map of Komárom county it can be deduced that there are 21 different groupings of the main agricultural plants within

the examined territory, so the program has delimited 21 types of habitat. By simplifying their distributional pattern and leaving out types occuring in a small area agro-ecological micro-regions can be described.

ZUSAMMENFASSUNG

Die Methode der agroökologischen Mikrorayonierung wurde von den Mitarbeitern der Abteilung Naturgeographie des Forschungsinsitutes für Geographie der Ungarischen Akademie der Wissenschaften unter Leitung von László GÓCZÁN 1983 ausgearbeitet. Die Methode ist hervorragend geeignet zur Feststellung, inwiefern die bestehenden agroökologischen Gegebenheiten optimal zum Anpflanzen der wichtigeren Kulturpflanzen genutzt werden können.

Zur Datenverarbeitung wurde ein Commodore PC 64 verwendet. Diese Computer-Einstufungsmethode wurde zuerst für das Komitat Komárom angewandt, dann für das Igmánd-Kisbér-Becken, zuerst also für eine Verwaltungseinheit, dann für eine naturgeographische Landschaftseinheit. Die Klassifizierung wurde mit einer zehnstufigen Skala zur Kodierung der "Zustände" von 21 sorgfältig ausgewählten Faktoren durchgeführt. (Diese Faktoren sind: 1. Gelände, 2.-9. klimatische Gegebenheiten, 10.-12. Niederschlagsverhältnisse, 13.-16. pflanzenspezifische Niederschlagsdaten, 17.-21. Bodengegebenheiten.)

Durch Auswertung der Agrar-Fachliteratur konnte festgestellt werden, welche Zustände der naturgeographischen Faktoren inwiefern den Ertrag der einzelnen Pflanzenarten begünstigen bzw. beeinträchtigen. Diese sog. "Anbaubarkeitsfaktoren" wurden mit den gespeicherten, die Umgebungszustände repräsentierenden Code-Nummern verglichen. Dann wurden die Gebietseinheiten von 25 ha in einer additiven Methode mit Punktewerten versehen. Die Punktezahlen wurden auf 10 Stufen aufgeteilt und so jeder Einheit von 25 ha eine der Stufen zwischen 0 und 9 zugeteilt. So konnten aufgrund der "Anbaubarkeit" der 6 Hauptkulturpflanzen 6 Zahlenkarten gedruckt werden und steht uns nun das Qualizifierungsergebnis für das untersuche Gebiet zur Verfügung, bezogen auf Weizen, Mais, Sonnenblumen, Zuckerrüben, Luzerne und Weinreben.

Schließlich wurden auf einer gesonderten Zahlenkarte, unabhängig von der Pflanzen, diejenige Werte dargestellt, die in die höchste Qualifizierungsgruppe eingestuft wurden.

Die "Anbauorttyp-Karte" des Komitates Komárom bzw. der Landschaft bildet die Grundlage zur agroökologischen Mikrorayonierung. Dieser kann entnommen werden, welche Pflanzenart oder Pflanzenartengruppe in den gegebenen Gebietseinheiten von 25 ha die höchste Bewertung bekommen hat, und zwar wurde der jeweilige Anfangsbuchstabe (und eine bestimmte Farbe) eingetragen. An Hand der Anbauorttyp-Karte des Komitates Komárom kann festgestellt werden, daß die Hauptkulturpflanzen im untersuchten Gebiet in 21 verschiedenen Gruppierungen vorkommen. Das bedeutet, daß das Programm 21 verschiedene "Anbauorttypen" festgestellt hat. Nach sorgfältiger Generalisierung können die agroökologischen Mikrorayone bestimmt werden.

* * *

1. INTRODUCTION

In the Geographical Research Institute of the Hungarian Academy of Sciences, traditional landscape studies culminated in the preparation of micro-, meso-, and macro-scale monographs on the 6 macroregions, 36 mesoregions and more than 200 microregions of Hungary. The description of the physical-geographical conditions and the land use of microregions as well as the collection of related parameters form the basis of a geographical information system.

80 per cent of the area of Hungary is agricultural land. Therefore, naturally, the school of landscape evaluation develop-

ed in the late sixties is primarily concerned with studies of agroecological character. This research provided practical suggestions for an effective agricultural production.

2. THE METHODOLOGICAL BASIS FOR THE COMPUTER ASSESSMENT OF LAND CAPABILITY

The new complex method for the evaluation of tracts of land is an exact scientific survey of the ecological requirements of specific agricultural crops (GÓCZÁN, L. 1978). By considering the relief, climatic conditions, water supply, soil type and the economic conditions, an "ecological score" of agricultural sites can be given in monetary terms.

It was furhter elaborated by L. GÓCZÁN and his working group in 1981 (GÓCZÁN, L. 1981). The potentials of main landscape factors (subsoil, relief, climate, availability of water, soils, vegetation and the mineral resources important for agriculture) are evaluated individially according to a system of ranks. The scores are represented on thematic maps. For square units of 100 ha each favourable or unfavourable conditions are indicated by numbers 0 (least favourable) to 9 (most favourable).

In 1984-85 the collective of the Department of Physical Geography applied a computer aided version of the above method (LÓCZY, L. and TÓZSA, I. 1982) for an assessment of agricultural conditions in Komárom county *(Fig. 1)*. The goal was to assess to what extent the existing agroecological conditions were suitable for the cultivation of specific crops.

The following factors provided the parameters coded for square units of 25 ha:

1. *Relief*: predominant and secondary slope categories, prevailing exposure and dissection of the surface.

2. Factors 2-16: *climatic* parameters, the factors 2-9 indicating 70-years monthly temperature sum for the growing season (from March to October), based on monthly means of meteorological data series. The factors 10-12 include precipitation measurements (for May, June, and July). The factors 13-16 contain cumulative precipitation sums for specific groups of plants (also based on 70-year averages).

3. The factors 17-20 code the most characteristic *soil* properties. (Factor 17 is genetic soil type and organic material content and no. 18 is depth of tilth and parent material, no. 19 is soil texture clas and no. 21 is the average depth of the groundwater table). Coding tables are exemplified by the one for factor 1 *(Table 1)*.

The detailed and labour-intensive nature of the survey is indicated by the fact that per 19by19 sheet, i.e. 361 areal units of 25 ha, were coded individually for each of the above factors, that means altogether about 7500 data per map sheet. The data were processed by means of a Commodore 64 personal computer.

Agroeconomic literature served as a basis for deciding what conditions were restrictive to what degree for the cultivation of particular crops. In this way *indices of suitability* were compiled. Then they were compared by the programme with the

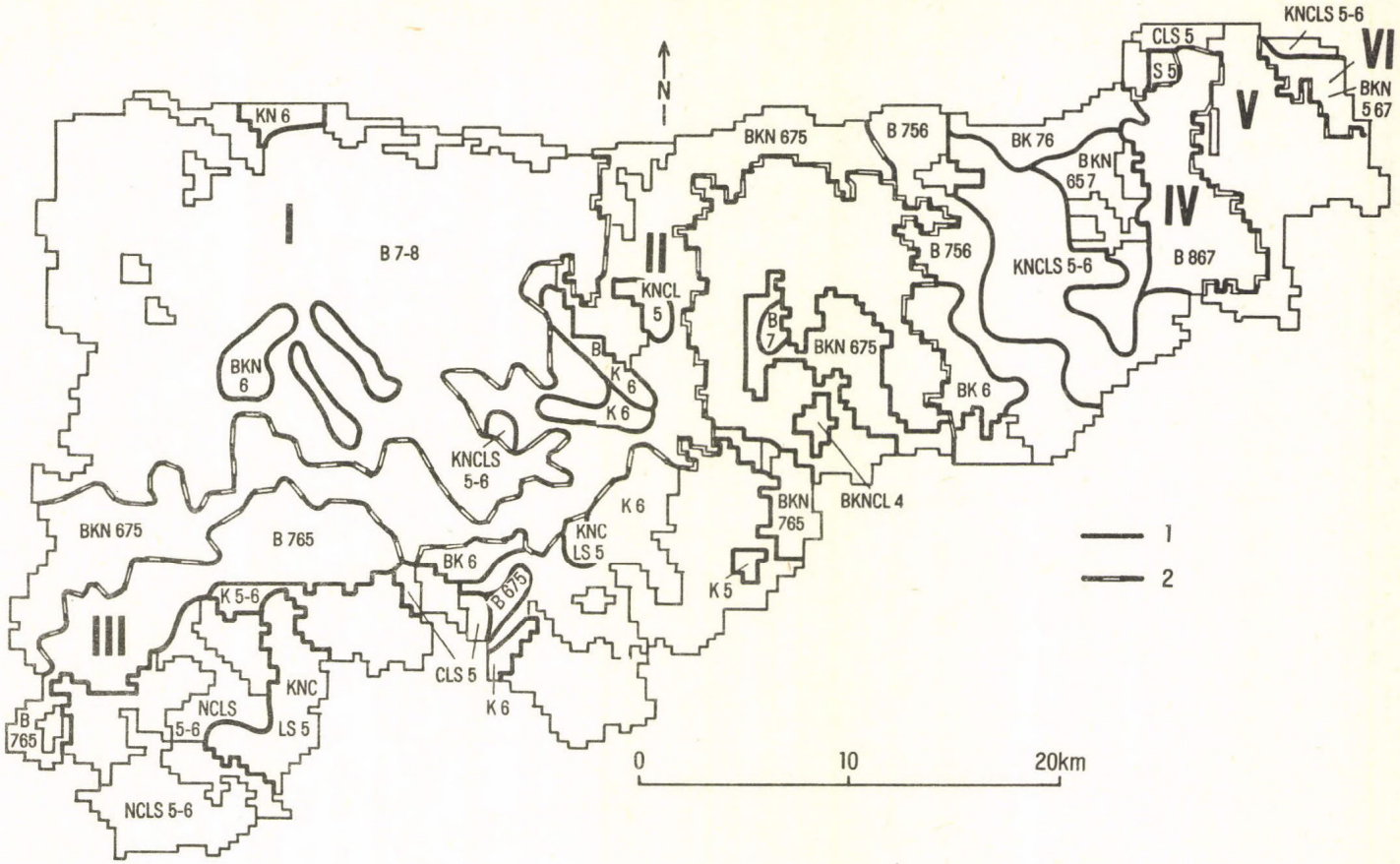

Fig. 1 Map of types of agricultural habitat and agroecological regions in Komárom county

1 = boundary of type of agricultural habitat; 2 = boundary of agricultural regions; B = wheat; K = maize; N = sunflower; C = sugar-beet; L = lucerne; S = grape

Table 1 Coding table for factor 1 (Relief)

Subordinate slope exposure	Subordinate slope category %										Predominant slope exposure	Horizontal dissection m/25 ha	Predominant slope category %
	25<			17 - 25			12--17	5--12	0--5	none			
	S SW	W E SE NW	N NE	S SW	W E SE NW	N NE							
	1									2		0	0--5
	3									4		1-500	
	5									6		500-1000	
	7									8		>1000	
	9								10	11		0	5--12
	12								13	14		1-500	
	15								16	17		500-1000	
	18								19	20		1000	
	21	22	23	21	22	23		24		25		0	12--17
	26	27	28	26	27	28		29		30		1-500	
	31	32	33	31	32	33		34		35		500-1000	
	36	37	38	36	37	38		39		40		>1000	
	41	42	43					44		45	N,NE	0	17--25
	46	47	48					49		50	W,E,SE,NW		
	51	52	53					54		55	S,SW		
	56	57	58					59		60	N,NE	1-500	
	61	62	63					64		65	W,E,SE,NW		
	66	67	68					69		70	S,SW		
	71	72	73					74		75	N,NE	500--1000	
	76	77	78					79		80	W,E,SE,NW		
	81	82	83					84		85	S,SW		
	86	87	88					89		90	N,NE	>1000	
	91	92	93					94		95	W,E,SE,NW		
	96	97	98					99		100	S,SW		
				101	102	103		149		104	N,NE	0	>25
				105	106	107		150		108	W,E,SE,NW		
				109	110	111		151		112	S,SW		
				113	114	115		152		116	N,NE	1-500	
				117	118	119		153		120	W,E,SE,NW		
				121	122	123		154		124	S,SW		
				125	126	127		155		128	N,NE	500--1000	
				129	130	131		156		132	W,E,SE,NW		
				133	134	135		157		136	S,SW		
				137	138	139		158		140	N,NE	>1000	
				141	142	143		159		144	W,E,SE,NW		
				145	146	147		160		148	S,SW		

coded values in the memory representing the conditions provided by the environment and, after carrying out some weighting, the score for each of the 25 ha units was established by an additive method. The scores were divided into 10 intervals and each 25 ha unit was given a final rank score ranging from 0 to 9. The result was six "numerical" maps for the cultivation of the six major crops.

3. THE RESULTS OF THE ASSESSMENT

The results of the assessment are presented for *the cultivation of wheat (Fig. 2).* The most favourable conditions for wheat growing are to be found on the Danube terraces of the Győr-Tata terrace region (score 8) and the least favourable are on the slopes of the Gerecse, Vértes and Bakony Mountains (5 to 2).

Fig. 3. shows the assessment for maize, Fig. 4 for sunflowers, Fig. 5 for sugar-beet, Fig. 6 for lucerne and Fig. 7 for viticulture.

Larger stretches of forests or water bodies and the built-up area were left out of assessment and appear in white on the grid maps.

The rank score 9 means the best environmental potential in Hungary for growing particular crops, and 0 means the least favourable. In this light the intermediate values both for lucerne and grapes for all of the country can be explained. (Attempts were made to subdivide this medium category of 5, and differences *could* be found.)

Finally, an additional map was drawn up *(Fig. 8)* showing irrespective of crops, the maximum values for each unit on any of the maps for individual crops. There is a clear zonation, the best agricultural sites being on the Danube terraces and in the Dorog-semibasin. The next zone is represented by most of the Igmánd-Kisbér-basin and the eastern part of the terrace region. The mountainous margins follow with potentials from medium to good. Poor to medium quality areas occur in the cultivated parts of hilly and mountainous regions.

The agroecological microregionalization presented is based on the map of agricultural sites in Komárom county *(Fig. 9).* It shows which crop or groups of crops received the highest rank score in each 25 ha unit. In the area investigated altogether 21 combinations of the 6 crops occur, i.e. 21 types of agricultural sites are distinguished. When generalizing the areal distribution of types and ignoring types of small areal extension, the agroecological microregion can be delimited.

The application of this method within administrative boundaries is, first of all, motivated by economic management goals and planning considerations. It is also useful, however, to apply it for a physical-geographical unit, e.g. for a microregion. In 1986 I prepared the agroecological microregionalization of the microregion Igmánd-Kisbér basin (533 km^2). As was to be expected, areas of larger size and with a higher degree of homogeneity could be delimited than in Komárom county.

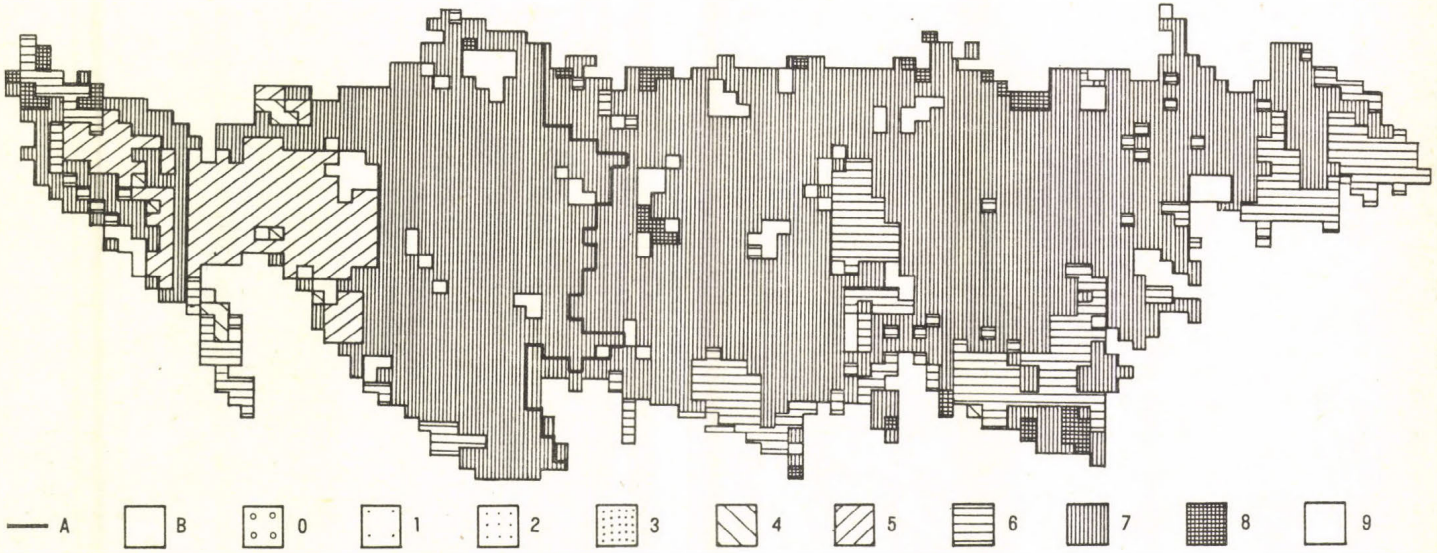

Fig. 2 Ecological suitability of the Igmánd-Kisbér basin for wheat cultivation

A = county boundary; B = non-agricultural area; 0 = unsuitable; 1 = very restricted; 2 = restricted; 3 = possible; 4 = neutral; 5 = suitable; 6 = good; 7 = favourable; 8 = very favourable; 9 = excellent

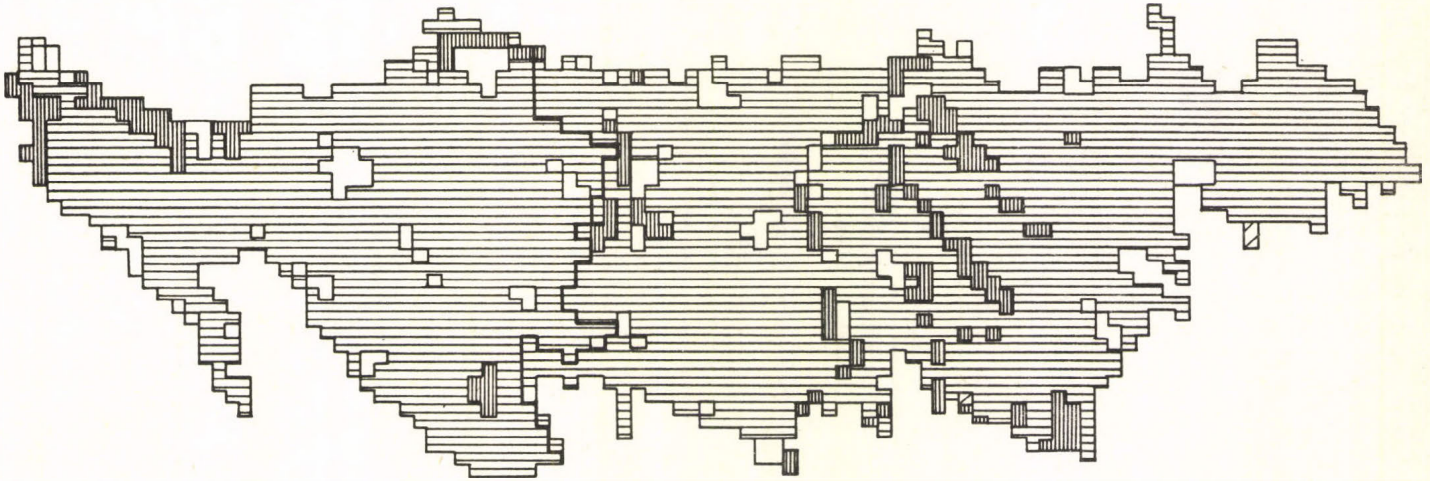

Fig. 3 Ecological suitability of the Igmánd-Kisbér basin for maize cultivation
(For legend see Fig. 2)

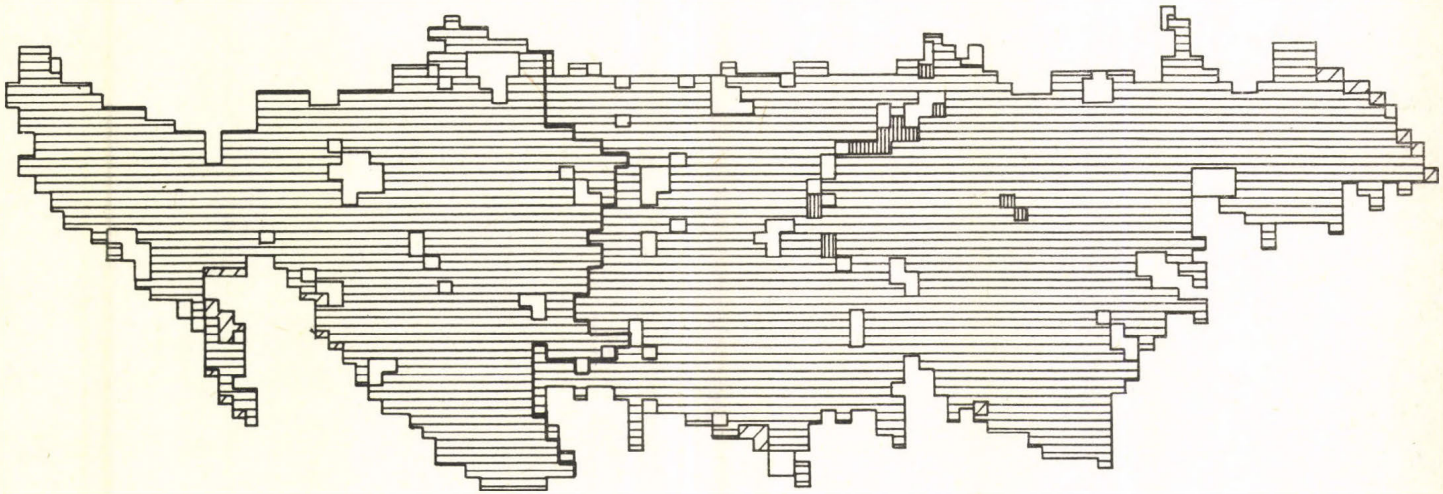

Fig. 4 Ecological suitability of the Igmánd-Kisbér basin for sunflower cultivation (For legend see Fig. 2)

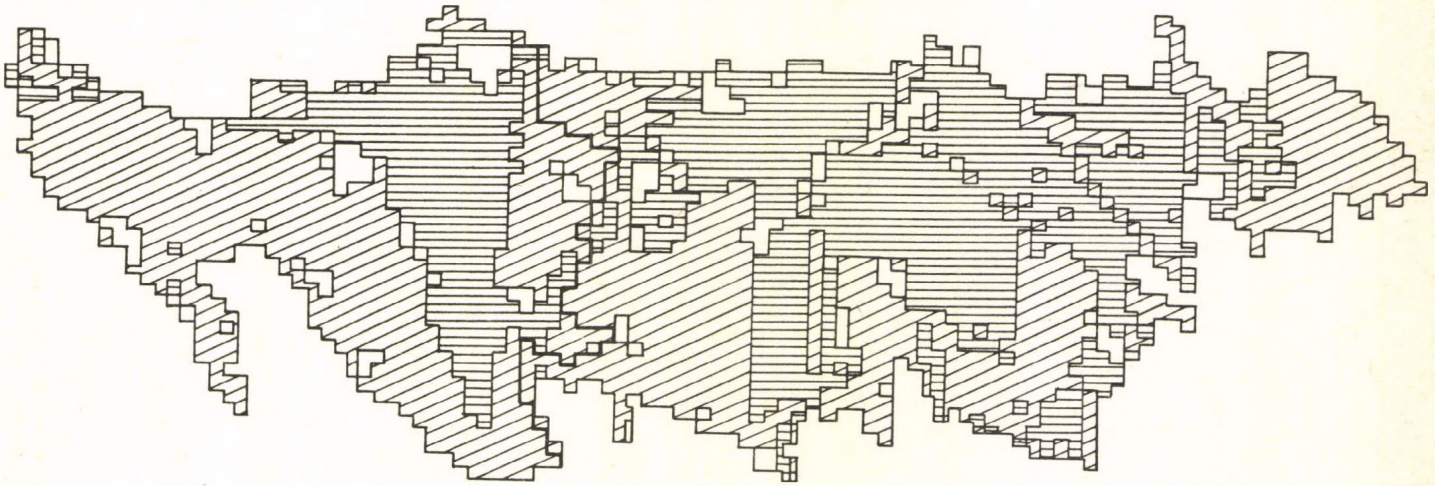

Fig. 5 Ecological suitability of the Igmánd-Kisbér basin for sugar-beet cultivation (For legend see Fig. 2)

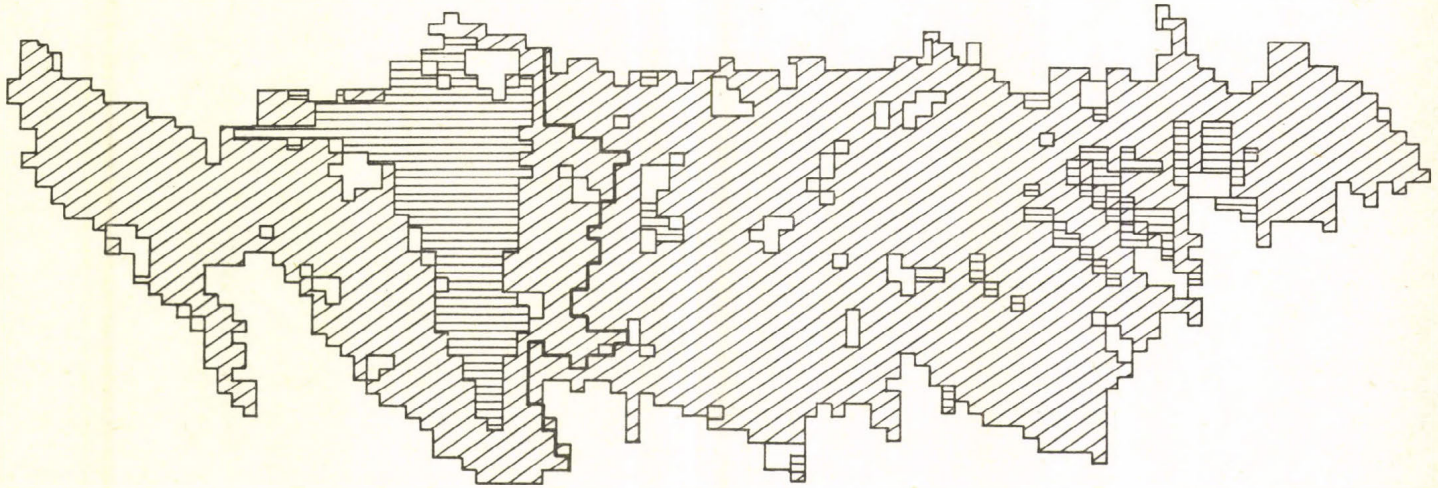

Fig. 6 Ecological suitability of the Igmánd-Kisbér basin for lucerne cultivation
(For legend see Fig. 2)

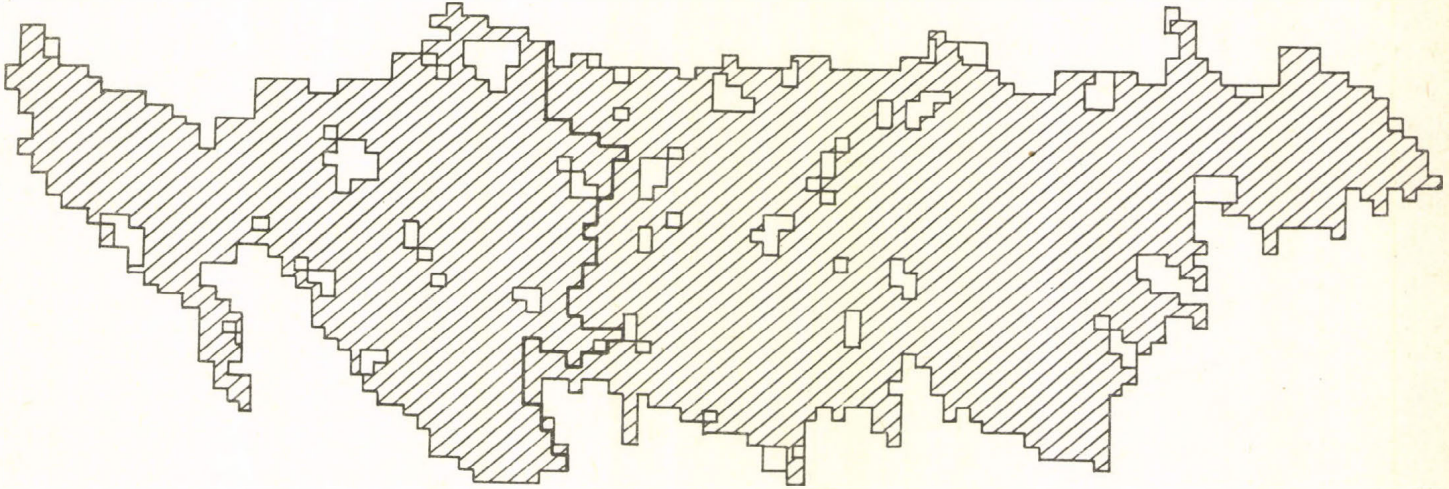

Fig. 7 Ecological suitability of the Igmánd-Kisbér basin for viticulture (For legend see Fig. 2)

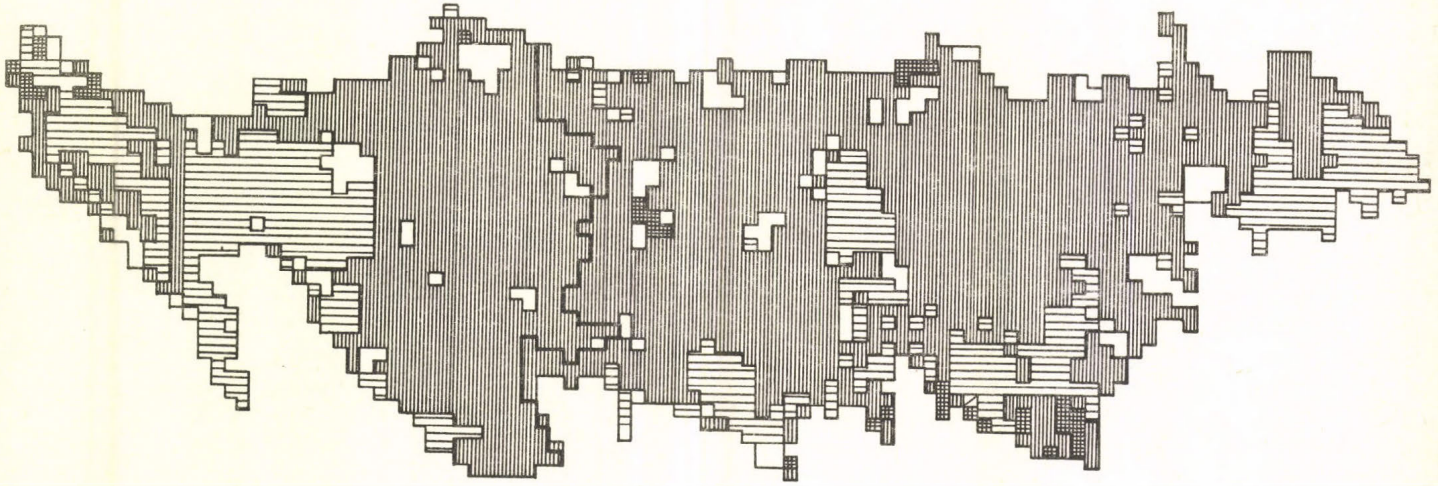

Fig. 8 Map of maximum suitability scores of the Igmánd-Kisbér basin
(For legend see Fig. 2)

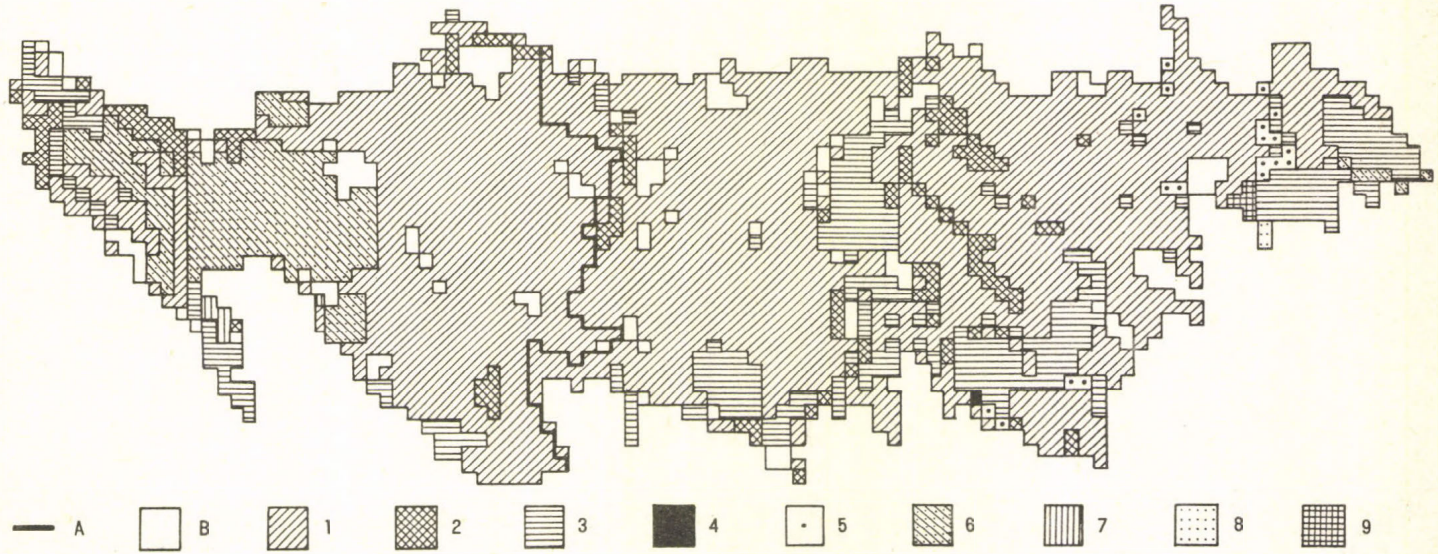

Fig. 9 Map of types of agricultural habitat in the Igmánd-Kisbér basin

A = county boundary; B = non-agricultural area (settlement, forest, water); 1 = wheat; 2 = wheat and maize alike; 3 = wheat, maize and sunflower alike; 4 = maize, sunflower, sugar-beet, lucerne and grape alike; 5 = maize; 6 = maize and sunflower alike; 7 = sunflower; 8 = wheat, maize, sunflower and sugar-beet alike; 9 = wheat, maize, sunflower and lucerne alike

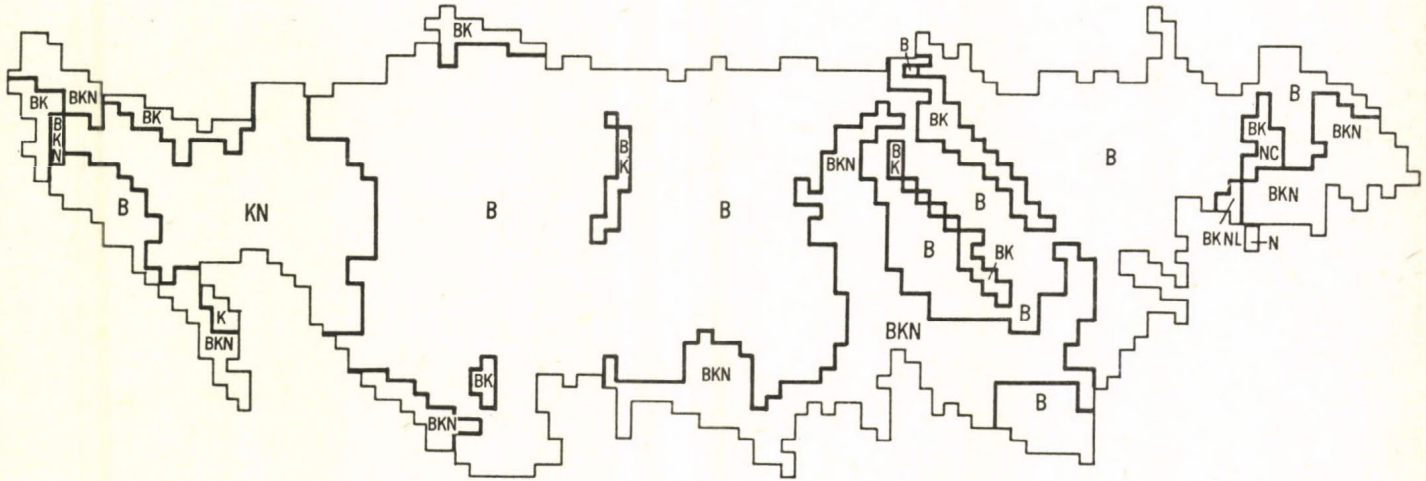

Fig. 10 Map of agroecological microregions in the Igmánd-Kisbér basin
(For legend see Fig. 1)

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A SURVEY OF THE ECOLOGICAL IMPACTS OF THE GABČIKOVO-NAGYMAROS SCHEME IN THE SZIGETKÖZ

by

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SUMMARY

In accordance with the intergovernmental agreement between Hungary and Czechoslovakia two river-barrage systems will be built on the river Danube, one of them in Slovakia, near the village of Bős (Gabcikovo), the other one in Hungary, near Nagymaros.

In this paper, the barrage-system near Bős is dealt with briefly and its ecological effects are discussed mainly.

The barrage-system consists of three parts: the waterbasin between Pozsony (Bratislava) and Dunakiliti, the operation water channels (low- and head-water channel) and the power station, built on the barrage. We are interested in the effects deleterious ecologically mainly that will follow the building of the barrage-system.

As the barrage system is built between the low and head-water channels, about 30 km of the river Danube cease to be the main branch.

According to the original plans the water discharge of this reach will be 50 m^3/sec; with respect to the ecological impacts this amount will be increased to 50 to 200 m^3/sec, while now the mean annual water discharge is 3000 m^3/sec.

This enormous difference will cause manifold deleterious effects after the opening of the system.

Szigetköz is a flood-plain between the main branch of the Danube and the Moson-Danube. The surface is covered here by various types of alluvial soils. These types of soils contain very little humus, so their fertility is very low. On the other hand the average yields of Szigetköz are generally much higher than in other parts of the country. This is possible, because the groundwater-level, fed by the Danube, is at the disposal of the plants in the zone of their roots, so high quantities of fertilizers have great effects here.

After the opening of the barrage-system, this useful groundwater will lack in the zone of the roots. the average yields will decrase quickly, therefore plant cultivation will suffer greatly. Further, long-term damage will be caused by an increasing concentration of magnesium in these soils.

The designers had intended to replace the natural amount of useful ground-water by infiltration from an artificial canal.

The findings of Prof. Márton Pécsi disprove an effective functioning of this canal. Buried meanders and dead channels, netlike traversing the flood plain, draw off the water, so these places become waterlogged and marshy and other parts of the territory remain dry.

According to the latest groundwater balance survey 65% of the territory of Szigetköz will suffer from the deleterious effect of the lack of ground-water.

Therefore we suggest to extract gravel in the areas where it lies higher than 1,5 m under the soil to such depth, that by putting back the deposited top soil of the exploited gravel-layers the ground-water, sinking down because of the barrage system, can reach this recultivated soil-layer, as a new zone of roots.

The exploited gravel can be utilized during the building of the barrage-system.

ZUSAMMENFASSUNG

Gemäß einem ungarisch-tschechoslowakischen Regierungsabkommen werden an der Donau zwei Staustufensysteme errichtet: das eine bei Bős (Gabčikovo) in der Slowakei, das andere in der Nähe von Nagymaros von Ungarn.

Im folgenden wird das Staustufensystem von Bős, genauer seine voraussichtlichen nachteiligen ökologischen Wirkungen, kurz behandelt.

Die Anlage von Bös besteht aus drei Teilen: dem Speicher zwischen Pozsony (Preßburg) und Dunakiliti, Betriebswasserkanälen (Unter -und Obergraben) und aus dem Kraftwerk. Wir befassen uns in erster Linie mit denjenigen ökologisch nachteiligen Wirkungen, die nach der Errichtung des Staustufensystems zu erwarten sind.

Die Staustufe liegt zwischen dem Untergraben- und Obergrabenkanal, daher wird eine etwa 30 km lange Strecke der Donau kein Hauptarm mehr sein.

Gemäß dem ursprünglichen Plan soll die Durchflußmenge dieser Strecke 50 m^3/sec, nach den neuesten ökologischen Wirkungsstudien 50-200 m^3/sec betragen, während die jetzige Durchschnitts-Durchflußmenge 3000 m^3/sec ausmacht.

Dieser bedeutende Unterschied in der Durchflußmenge wird nach Inbetriebsetzung des Systems nachteilige Wirkungen haben.

Die Region Szigetköz ist eine bei Hochwasser überflutete Ebene zwischen dem Donau-Hauptarm und dem Donauarm Moson. Es kommen überwiegend Schwemmland-Böden vor. Diese enthalten wenig Humus und sind daher nicht besonders fruchtbar, die Erträge von Szigetköz lagen aber dennoch wesentlich über dem Landesdurchschnitt.

Dies war möglich, weil Grundwasser von der Donau her in der Wurzelzone der Pflanzen zur Verfügung steht und die reichen Kunstdüngergaben einen hohen Wirkungsgrad erreichen.

Nach Inbetriebsetzung des Staustufensystems steht nun in der Wurzelzone kein Grundwasser mehr zur Verfügung, die Durchschnittserträge sinken plötzlich und der Pflanzenbau wird wohl schwerwiegende Einbußen erleiden. (Das nächste zu erwartende Problem wird in einer Anreicherung von Magnesium im Boden in gefährlicher Konzentration bestehen.

Die Konstrukteure wollen das so wichtige Grundwasser durch Sickerwasser aus einem eigens gebauten Kanal ersetzen.

Die Untersuchungsergebnisse von Prof.Márton PÉCSI bezweifeln die Wirksamkeit eines solchen Kanals. Das dieses Hochwassergebiet dicht überziehende Netz begrabener Mäander und Totarme saugt das Sickerwasser des Kanals ab, diese Stellen werden übermäßig feucht sein, andere demgegenüber trocken.

Nach den neuesten Untersuchungen des Grundwasser-Haushaltes werden etwa 65% des Gebietes von Szigetköz von der schädigenden Wirkung des Bodenwassermangels betroffen sein.

In den Gebieten, in denen Kies-Ablagerungen sich weniger als 1,5 m unter der Bodenoberfläche befinden, soll der Kies bis zu einer gewissen Tiefe abgebaut und der ursprüngliche Boden auf die verbliebene Kiesschicht aufgebracht werden.

Das wegen der Staustufe absinkende Grundwasser sollte dann diese rekultivierte Bodenschicht als neue Wurzelzone erreichen.

Der gewonnene Kies könnte bei den Bauarbeiten des Staustufensystems, z.B. Betonherstellung, verwendet werden.

* * *

1. INTRODUCTION

The governments of Hungary and Czechoslovakia signed a bilateral agreement about the construction of the Gabcikovo (Bös) Nagymaros Barrage System on Sept. 16, 1977. Accordingly, the Hungarian and the Czechoslovak side jointly regulate the section of the Danube between Bratislava (Pozsony) and Budapest. For most of this stretch, the border between the two countries runs along the line of maximum velocity of the Danube.

The four basic objectives of the agreement are:

I. The Barrage System (GNV) should ensure safe and modern navigation;
II. protect the area from inundation;
III. produce electricity shared equally by the sides;
IV. promote economic growth in the area.

The first three goals are primarily technological issues. The fourth point can be reformulated as: The population carrying capacity of the area and the incomes should not be reduced but increased. This is the focus of our investigations.

Szigetköz is a region of agriculture and forestry. The area of 375 km^2 between the Danube and the Moson-Danube is part of the Quaternary alluvial fan of the Danube, mostly with alluvial soils. Boreholes indicate that cover layers of varying thickness are underlain by fluvial gravel. This gravel mantle brings about a strong correlation between the groundwater table and the water level of the Danube.

The diversion canal with an impermeable concrete lining to be built in Czechoslovakia will be able to hold a discharge of 4000 m^3 per second. A discharge more than 50 m^3 per second will only be diverted into the abandoned "Old Danube" if the total discharge exceeds 4000 m^3 per second, that is twice a year, during floods. Since the groundwater table of the Szigetköz depends on the amount of water in the "Old Danube", the construction of the diversion canal involves a major drop of the groundwater-table of this degree is harmful for both agriculture and forestry, as in the areas where the groundwater sinks into gravel beds below the fertile cover layers the previous output can only be regained through irrigation, since in the gravel beds the capillary rise of water does not reach up to the root zone. The alluvial soils in the area affected by the GNV are of poor fertility, and agricultural yields are only above the national average because the roots reach the groundwater during the critical periods of plant growth.

The designers of the barrage system, the VIZITERV, plan to make up for the water loss constructing an infiltration canal traversing the affected are from W to E. The infiltration canal is intended to collect water pressed through the Dunakiliti dam and will have a discharge of 50 m^3 per second.

2. METHODS AND RESULTS

The investigations by the Geographical Research Institute of the Hungarian Academy of Sciences showed that the water seeping

from the infiltration canal will be collected by, and stored in, the remnants of the old meander network of the Szigetköz. Thus, the high floodplain terrain rising above its environs will not receive any water. Therefore, the efficiency of the infiltration canal should be reconsidered. For arriving at a decision, reliable facts and figures have to be collected in those areas where a drop of the groundwater table may have an adverse impact on agriculture.

The relationship between the amount of water in the Danube channel and the height of the groundwater table becomes less marked with distance from the canal, but the actual impact is controlled by landforms, the thickness of cover layers and the nature of parent material (e.g. its grain size composition). A detailed survey of the affected area is essential for the estimation of the damage to agriculture and forestry caused by the GNV and for the determination of compensation costs. In order to solve this problem, types of groundwater budget were identified and their areal distribution mapped according to the relative positions of the cover layer and the groundwater table. The types of groundwater budget are listed below.

I. The groundwater reaches the cover layer and ranges in it. Infiltrating rainwater does not reach the capillary zone. Plants are supplied with rainwater only.

II. The groundwater reaches the cover layer and ranges in it. The zone of infiltrating rainwater reaches down to the capillary zone. Plants are suppied with both rainwater and capillary water.

III. The groundwater reaches up to the cover layer. The cover layer is completely permeated by the rainwater. The rainwater is not used up entirely, and the plants have an additional water supply from groundwater, too, depending on the frequency with which the groundwater table reaches the cover layer.

IV. The groundwater range effects the gravel bed under the cover layer and, consequently, there is no capillary zone. The cover layer is deeper than the zone wetted by rainwater. Plants receive rainwater only.

V. The groundwater table lies below the cover layer. There is no capillary zone. The cover layer is shallower than the zone wetted by rainwater. Only stored rainwater is available for the plants (GÓCZÁN, L. 1984).

The depth of the root zone of the widest-spread crops had to be determinded, too, since a typification of the groundwater budget must refer to it. For the crops grown in the Szigetköz, this depth was estimated to be 1.5 m on an average. For the survey, the study of the average depth of the groundwater table during the growing season was indispensable. The data were taken from the 1 m isopleth map made on commission by the VITUKI in 1981.

In a next step we had to determine the height of capillary rise in the profiles, depending on the grain size composition of the cover layers. The following parameters were used in the investigation:

- grain size composition (percentages),
- 24-hour and 48-hour height of capillary rise,

- maximum capillary rise as a function of grain size composition,
- number of days necessary for maximum capillary rise.

The descriptions of profiles show that the gravel is predominantly overlain by sands of various grain size and silts. With regard to the sand-silt cover layers, the upper boundary of the capillary zone was determined at 2.5 m. The 48-hour capillary rise and the maximum thickness of the capillary zone were also taken into account. Extreme values were included for extreme granulometric compositions, but corrected, particularly in the case of clay, by controlling for extreme amounts of dead water.

The classification of the water budget types for the profiles (of which a small number is available) showed that obviously for more than 65 per cent of the Szigetköz regular and above-average yields depend upon the present mean water level of the Danube during the growing season.

One of the most important issues for estimating the environmental impact of the GNV is to decide whether this influence of the mean groundwater table during the growing season holds true overall. The soil profile analyses available at present are by no means adequate for settling this question. First of all, a detailed map of the thickness of the cover layer should be made, since the 213 soil profiles available now are only adequate for drawing general conclusions. For an efficient infiltrational canal system, we feel, boreholes should be arranged in a 25-hectare square grid pattern at least.

The construction of the GNV and the resulting lowering of the groundwater table will, moreover, involve changes in groundwater flow direction: Subsurface flow will turn towards the Danube channel. It is difficult to prognosticate how this process will influence groundwater quality and opportunity of near-surface water intake.

These influences can be regarded as adverse for land use. If they become active, the users of the land will suffer financial loss. There are no measures mentioned in the agreement as to a prevention or reduction of damages, and neither has the amount of probable damage been estimated. The subsidies cut out for compensations seem to be insufficient. Though the establishment of an infiltration system and supplementary surface irrigation facilities can be ensured by raising the projected costs, operation and maintenance costs will rest with the users. The degree of damages is highly dependent on the efficiency of the infiltration system. Thus, it is not surprising that several plans were designed. Those proposed by the VIZITERV would cost 540 million Ft, and a plan involving an investment 1200 million Ft also exists which is supposed to bring about higher yields and, thus, would recover the surplus cost.

Of the 30,000 hectares of the Szigetköz, a little less than 9,500 hectares have been mapped as to genetic soil types at a sclae of 1:10,000 (the area of four cooperative farms). There is no water budget cartogram available.

2.1. Impacts on forestry

By the GNV the total amount of timber exploitable will be reduced by 700,000 to 750,000 m^3. Moreover, the income from forestry

will decrease in proportion to the area utilized. The loss of timber has to be compensated by new plantations that can only be made in areas unsuitable for agricultural land use and the per hectare output will be only half of that of forests in the active flood-plain, the owner, the Kisalföldi Erdö- és Fafeldolgozó Gazdaság (Little Plain Forestry and Timber Processing Enterprise) will have to plant 1700 hectares of forests in order to replace its 877 hectares of inundated forest area and an additional 1300 ha to compensate for the loess caused by the lowering of the groundwater table. The damage could be reduced if the projected subsoil irrigation were sufficient to supply water recharge in the active flood-plain, but the proposed capacity of the infiltration canal and the increased discharge of the Old Danube channel (200 m^3 per second) will certainly be too small (Draft of... 1983 (III/3;3.), Presentation... 1983).

2.2. Impacts on the arable land in the Szigetköz

This is the only type of land use that has been surveyed in detail with respect to predictable impacts by the KAE Termelésfejlesztési Intézet (Institute for the Development of Production) in 1981. Regarding the yields of arable farming for this year (285,467,000 Ft) the loss caused by the implementation of the GNV was estimated at 22,202,400 Ft per year and assumed to increase to 27,279,200 Ft by 2000, that is a 7.8 per cent annual loss!

An earlier estimate had predicted total damages of 300 million Ft by 1988, only referring to 17,300 ha of the affected area, however. The actual extension of impacts is much greater, and therefore the estimate has risen considerably.

A sinking groundwater table leads to reduced air moisture, a factor which had always moderated evaporation in the Szigetköz, and, consequently, drought hazard increases.

A way feasible to avoid adverse effects is to ensure the capillary rise of water into a zone defined according to the demands of the plants (i.e. 1-2 m below surface). If not designed properly, there may be severe secondary consequences. As infiltrating rain and irrigation water and capillary soil moisture meet in the root zone, the large amounts of magnesium ions adsorbed in the soils of the Szigetköz may concentrate to the degree that a hardpan impassable by the roots forms and reduces the depth of tilth. If this hardpan is exposed by deep ploughing, the see-bed (germination horizon) is destroyed (Draft of... 1983).

2.3. Impacts on water stored in aquifers

The Quaternary gravel beds and the underlying fine-grained Pannonian layers of the Little Plain store cca 10 km^3 of confined groundwater. There is an easy hydraulic communication between free-surface groundwater and the water stored in the Quaternary sandy-gravelly aquifer that is 100-400 m thick. According to investigations performed in the VITUKI (Centre for Water Resources Management Research), the water held in aquifers is recharged

every three years. Though the lowering of the groundwater table induced by the GNV will be manifested in lower water levels of wells, their discharge will not be affected substantially. Water quality is, however, expected to deteriorate even though it is not really excellent presently, since groundwater flow will turn towards the abandoned Danube channel. In evaluating the impacts, it should be borne in mind that the water resources are also exploited by the Slovakian side, with an intake higher than by Hungary. As confined groundwater under the Little Plain is little explored with regard to geological structures and hydrological conditions, a major hydrogeological project is to be launched. It should study long-term large-scale water intake, too. The area can be envisaged as a future source of drinking water of Budapest, as the bank-filtered wells of the city will rapidly lose in discharge along with the increasing siltation of the Danube channel (Draft of... 1983, MAJOR, P. 1972).

2.4. Other kinds of damage

The aesthetic changes and alterations of habitats are to be considered here which appear harmful as some of the present landscape factors will be modified. At present fishing and hunting are negligible in this area and, thus, their reduction would not cause any considerable ecnomic damage. Nevertheless, the protection of waterbody sites decisive in the biological chain of the stream and the conservation of the traditional landscape are tasks which, if neglected, influence the attitudes of people adversely, particularly with respect to their dwelling places. Therefore, these aspects should be considered by the political leaders. The prevention of this kind of damage was not included into the agreement, although it is believed that an optimal reduction of damages to agriculture and forestry with simultaneous consideration of all possible impacts would diminish the harm done to the physical environment.

The indispensable tasks concerning a reduction of damages of the GNV are

- to delimit the precise area affected by the GNV (on detailed maps 1:10,000);
- to map, on a scale of 1:10,000, the genetic soil types in the Szigetköz, for a belt of cca 5 km width south of it and of the area affected at Nagymaros, supplemented with humus content, mechanical composition, tilth depth, exchangeable cations, water capacitiy and capillary rise cartograms;
- to interpret the types and point out the exact boundaries of the areas to be delimited from remote sensing information;
- to map the thickness of cover in the Szigetköz in proper detail;
- to map groundwater budget types in the Szigetköz in proper detail in order to obtain reliable information on the damages for crop cultivation;
- with all possible alternatives in mind, future land use and crop patterns, adjusted to economic varieties of groundwater control should be planned;
- finally, based on the information available, a detailed plan of action should be designed.

The estimation of predictable damages and actual costs for this prevention is promoted by land evaluation through a new system of soil mapping.

Let us present a final proposal to be considered for reducing damages to agriculture:

The areas of water budget types nos III and V has to be delimited precisely and, thus, the extent of the area with gravel to be excavated to the groundwater table of the growing seasion after the completion of the GNV. The original shallow tilth should, however, be spread again after removing the gravel. The price for the building material would equate the reclamation costs, and areas of poor productivity would become excellent sites.

During a second stage, the same procedure could be carried out for areas in category II, although here higher costs would emerge for depositing and re-spreading. The extra cost could be recovered as a result of improved conditions for cultivation. With the types II, III, and V being located side by side, simultaneous reclamation would remedy the limitation of fertile layer. Those should be considered in the design of the infiltration system.

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III. MULTIVARIATE TECHNIQUES

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PHENOMENA AND TYPES OF TOURISM IN AUSTRIA RESULTS OF A MULTIVARIATE ANALYSIS

by

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SUMMARY

In this paper an attempt is made to point out the respective importance of phenomena of tourism in Austria by means of a stepwise factorial analysis and to arrive at a typology of tourism communes by following it up with a cluster analysis. Methodologically the model for this study is the research project on "city development and factorial ecology" of the Commission on Regional Research of the Austrian Academy of Sciences. The source for the data is the ISIS data bank of the Austrian Central Statistical Office.

The following aspects pertaining to tourism were included into both the factor and the cluster analyses by means of the indicators listed below:

1. the size of the tourism communes according to the number of overnight stays in the winter and summer half-years,
2. the intensity of tourism according to the number of overnight stays per inhabitant and the number of enterprises catering for tourists per inhabitant,
3. the quality of the accommodation etc. offered according to the "A1A" and "B" beds available per inhabitant and the number of beds available in the summer and winter seasons.
4. the seasonality of tourism according to the respective importance of the summer and winter seasons,
5. the external effects as to demand according to the proportion of foreign guests in the summer and winter half-years,
6. the length of stay according to the average number of days in the winter and summer half-years,
7. the commercialization of the tourist industry according to the proportion of beds in commercial enterprises in the summer and winter half-years,
8. the trends to be observed according to the developments in the summer and winter seasons for the 1981-1985 period.

1611 tourism communes were included into the study. "Outliers" were not eliminated, as their influence on the results was negligible .

ZUSAMMENFASSUNG

Ziel dieses Beitrages ist es, mittels einer schrittweisen Faktorenanalyse den Stellenwert der Phänomene des österreichischen Tourismus offenzulegen und im Anschluß daran durch den Einsatz eines clusteranalytischen Verfahrens eine Typsierung der Fremdenverkehrsgemeinden vorzunehmen. Der methodische Aufbau der Arbeit orientiert sich an dem Forschungsprojekt "Stadtentwicklung und dynamische Faktorialökologie"[1].
Das verwendete Datenset stammt aus der ISIS-Datenbank des Österreichischen Statistischen Zentralamtes.

Folgende Dimensionen des Fremdenverkehrs wurden mittels Variabler in die Faktorenanalyse und die nachfolgende Clusteranalyse aufgenommen:

1. die Größe der Fremdenverkehrsgemeinden, gemessen durch die Übernachtungszahlen im Winter- und Sommerhalbjahr,
2. die Intensität des Fremdenverkehrs, gemessen durch die Quote der Übernachtungen pro Einwohner sowie die Quote der Beherbergungsbetriebe pro Einwohner,
3. die Qualität des Angebots, gemessen durch die Zahl der sehr guten und guten Betten pro Einwohner bzw. das Bettenangebot in der Winter- bzw. Sommersaison,
4. die Saisonalität des Fremdenverkehrs, gemessen durch den Anteil des Sommerfremdenverkehrs bzw. Winterfremdenverkehrs,
5. die Fremdsteuerung in Hinblick auf die Nachfrage, gemessen durch den Ausländeranteil im Winter- bzw. Sommerhalbjahr,
6. die Aufenthaltsdauer, und zwar mit der durchschnittlichen Anzahl von Tagen im Winter- bzw. Sommerhalbjahr,
7. der Kommerzialisierungsgrad der Fremdenverkehrsbetriebe, gemessen durch den Anteil der Betten in Gewerbebetrieben im Winter- bzw. Sommerhalbjahr und
8. der Entwicklungstrend mit den Indizes für die Winter- bzw. Sommersaison in Zeitraum von 1981-1985.

In die Analyse einbezogen wurden 1611 Fremdenverkehrsgemeinden. "Ausreißer" wurden nicht eliminiert, da eine Ausgliederung das Ergebnis nur unwesentlich verändert hätte.

* * *

1. THE RESULTS OF THE STEPWISE FACTOR ANALYSIS

The aspects of tourism mentioned above were studied by means of a *stepwise factor analysis* in the following manner:

In a *first step* the indicators for the demand as well as the variables characterizing the intensity were included.
In the *second step* the indicators of the quality standards offered and of the degree of commercialization were added.
In the *third step* the external effects and the length of stay were taken into account additionally.
In the *fourth step*, moreover, the seasonality and the trends were considered.

Below the proportion of the explained variance is given for the individual factors and the most important findings are described.
In the *first step* it is made obvious in an impressive way, that, on the communal level, it is first of all the intensity factor (explained variance: 82%) which differentiates types

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[1] LICHTENBERGER E., H. FABMANN und D. MÜHLGASSNER, 1987. Stadtentwicklung und dynamische Faktorökologie. Beiträge zur Stadt- und Regionalforschung 8, Österr. Akademie d.Wissenschaften. (Wien). 222 pp.

Table 1 Stepwise factor analysis of Austrian tourism communes

FAC-TOR	STEPS			
	1	2	3	4
I.	I. INTENSITY 82% +++ enterprises providing accomodation per inhabitant +++ overnight stays per inhabitant +++ A1A and B beds per inhabitant	I. INTENSITY 51% +++ enterprises providing accomodation per inhabitant +++ overnight stays per inhabitant +++ A1A and B beds per inhabitant + degree of utilization in winter (weighted)	I. INTENSITY 39% ++ enterprises providing accomodation per inhabitant +++ overnight stays per inhabitant +++ A1A and B beds per inhabitant	I. INTENSITY 36% +++ enterprises providing accomodation per inhabitant +++ overnight stays per inhabitant +++ A1A and B beds per inhabitant
II.	II. SIZE 18% +++ overnight stays winter +++ overnight stays summer	II. QUALITY 24% +++ A1A and B beds (winter 1985) +++ A1A and B beds (winter 1985)	II. QUALITY 19% +++ A1A and B beds (winter 1985) +++ A1A and B beds (summer 1985)	II. SEASONALITY 17% --- proportion summer 1985 ++ proportion winter 1975 ++ degree of utilization winter (weighted)
III.		III. SIZE 16% +++ overnight stays winter +++ overnight stays summer	III. EXTERNAL EFFECTS 12% +++ foreigners, winter +++ foreigners, summer	III. QUALITY 11% +++ A1A and B beds (winter 1985) +++ A1A and B beds (summer 1985)
IV.		IV. COMMERCIALIZATION 9% +++ proportion of commercial enterprises (winter) +++ proportion of commercial enterprises(summer)	IV. COMMERCIALIZATION 11% +++ proportion of commercial enterprises(winter) +++ proportion of commercial enterprises(summer)	IV. EXTERNAL EFFECTS 10% +++ foreigners, winter +++ foreigners, summer
V.		V. SEASONALITY 8% --- proportion summer 1985 +++ degree of utilization in winter(weighted)	V. SEASONALITY 8% --- proportion summer 1985 ++ degree of utilization in winter(weighted)	V. COMMERCIALIZATION 8% +++ proportion of commercial enterprises (winter) +++ proportion of commercial enterprises (summer)
VI.			VI. SIZE 7% ++ overnight stays winter +++ overnight stays summer	VI. SIZE 7% +++ overnight stays winter +++ overnight stays summer
VII.			VII. LENGTH OF STAY 5% +++ length of stay in winter +++ length of stay in summer	VII. LENGTH OF STAY 6% +++ length of stay in winter +++ length of stay in summer
VIII.				VIII. TREND 5% + winter 1981-1985 +++ summer 1981-1985

of tourism, whereas the size factor accounts for 18% only. This finding is a very important one as the planning authorities as well as the decision-makers tend to base their decisions on the absolute quantity only and do not consider the intensity, that is the relationship with the number of inhabitants.

The intensity factor, naturally, seems to lose weight in *step 2*, whereas the quality factor attains second rank. Interestingly enough the degree of utilization that was included with respect to the concept of probability, could not form a factor of its own.

Moreover it was found that there is a correlation coefficient of 0.56 only between the profitability values for the summer and winter seasons, that the degree of utilization of the beds in summer shows no high loadings on any factor and that only the respective figures for the winter season contribute to the intensity factor.

In the *third step* the guests as such and, thus, the consumers' side with respect to external effects as well as the length of stay and type of stay (cure at a spa, recreation leave, short holiday etc.) are included into the factor analysis. The external effects obviously play an important role and occupy rank 3 behind the intensity and quality factors, whereas the size factor loses ground and the length of stay can explain only little of the variance.

The seasonality and the trends are introduced in *step 4*. *Table 1* represents a summary of the findings of the factor analysis.

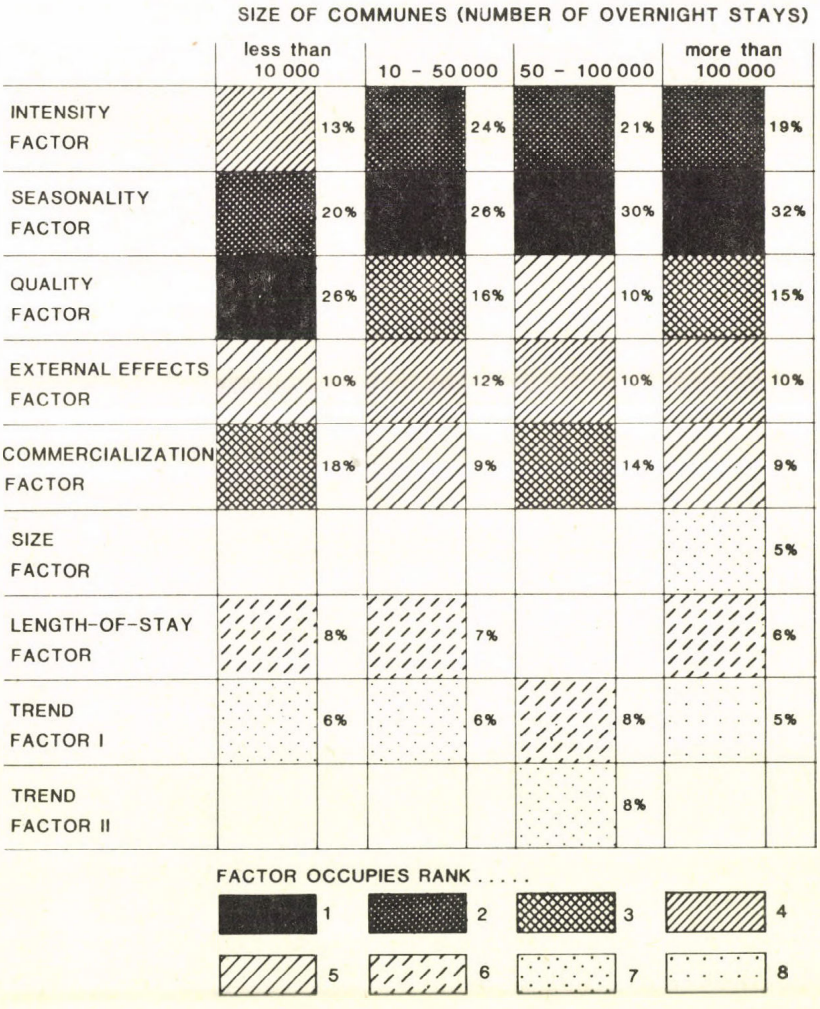
The respective ranks of the factors and the pattern of variables in them allow for the following statements:

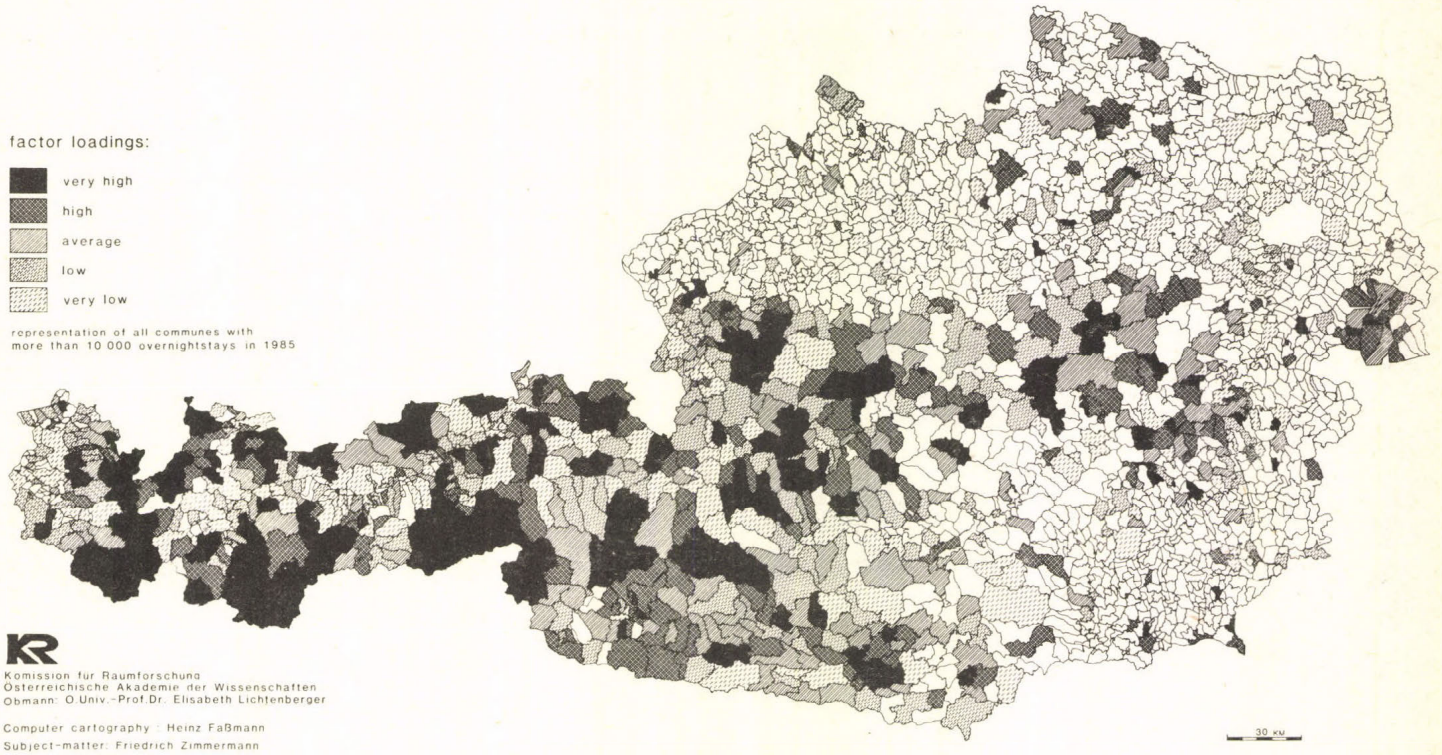
1. The intensity factor and, thus, the numerical relationship between supply and demand and the indigenous population, retains first rank for all steps.
2. The seasonality factor occupying second rank is mainly characterized by the positively loading proportion of the winter season and the utilization of beds in commercial enterprises in winter, while the variable of the proportion of the summer season loads negatively.
3. The third factor represents the quality aspect.
4. Considering the proportion of variance explained, it is closely followed by the external effects factor (10%) determined by the proportion of foreign guests.
5. Only 8 percent of the variance are explained by the fifth factor, that of commercialization, which represents the relative shares of beds in commercial enterprises and let in private homes.
6. It is a rather surprising fact that the size factor is of fairly little importance.
7. The length of stay factor can also contribute little to the explanation of the variance.
8. On the other hand it was to be expected that the trend factor would occupy last rank because of the general stagnation of tourism in the 1981-1985 period (5%). It proves, however, that tourism, on the whole, constitutes a fairly "stable system", in which the spatial processes of differentation have, more or less, come to an end.

2. DIFFERENTIATION OF THE RESULTS OF THE FACTOR ANALYSIS WITH RESPECT TO THE NUMBER OF OVERNIGHT STAYS

The 1611 communes studied were divided up according to size groups in a further analysis with respect to the number of overnight stays. The results are presented in the scheme below (cf. *Table 2*).

Table 2 The results of factor analyses with respect to the sizes of the communes





Map 1 Tourism in Austria. A multivariate analysis of communes. Factor 1 = tourism as an economic factor

The smallest communest with up to 10 000 overnight stays constitute the majority of all the tourism communes (44%), but the 2.7 million overnight stays in them amount to 2.4% of the total number only.

With respect to the relative position of the various factors this group clearly differs from all the others. The quality factor explains 26% of the overall variance, but is a "negative factor", reflecting a markedly below-average proportion of "A1A" and "B" beds (the mean is about 15% here against 30% in the very next group). The commercialization factor shows the highest explanatory value (18%), due to the fact that, in most cases, all that is offered to the guests are one or two low standard inns while hardly any rooms are let privately. Therefore, these communes are little in demand with foreigners, and the intensity of tourism is low.

The communes with between 10 000 and 100 000 overnight stays account for 20% of the total number. Seasonality is of great importance with them, with the winter season predominating and characterizing the first factor, whereas the degree of commercialization is low. This latter fact signifies that the letting of rooms in private houses has some significance. Some of these are part of a "suburban fringe" of tourist centres.

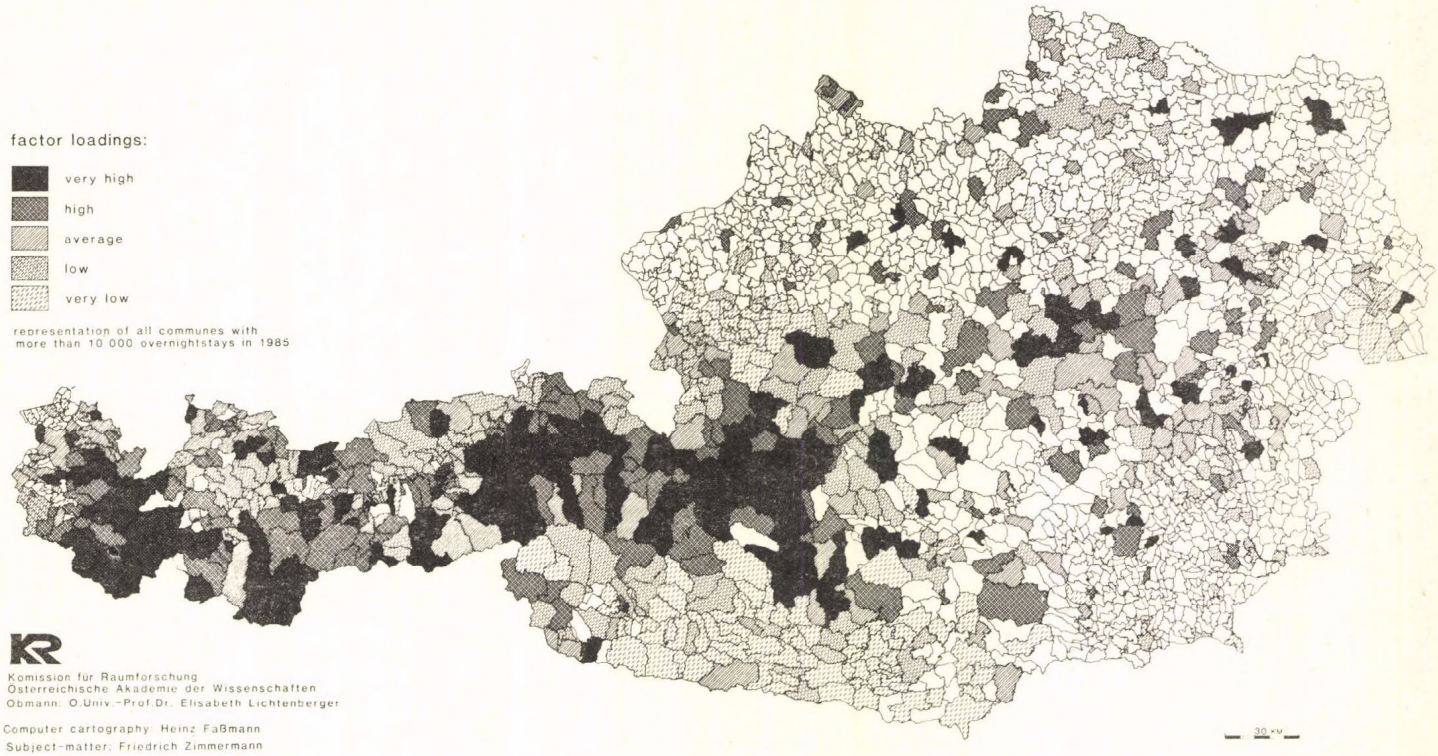
263 communes show a figure of more than 100 000 overnight stays per year, with a total of 87.2 million, that is 77% of the total number. Due to a large variation in the number of overnight stays there is a specific size factor to be found for this group, seasonality occupies rank 1, however (32%), and points to the fact that the winter season is of utmost importance in these communes.

3. THE SPATIAL DISTRIBUTION OF THE SPECIFIC ASPECTS

A methodological remark seems to be appropriate here. The representation of the factor loadings in maps was based on a quintile classification, with the total number of communes divided up into five equal parts of about 180 each, thus defining a classification principle giving equal chances to all communes. Therefore, naturally the tresholds separating the classes from each other are different in the various maps.

Map 1 depicts the intensity factor, characterizing the dependence of the respectives communes on tourism. High loadings of this factor are to be found in western Austria mainly, where the communes are dominated by winter tourism, but also with a few places in the Northern Limestone Alps, e.g. in the Lech valley, on the Seefeld Plateau and around the Achensee, whereas the Inn valley clearly is a zone of lower intensity. The same is true of the Rhine valley in Vorarlberg and the Salzach valley in Salzburg.

There still is a marked division between western and eastern Austria, with the delimiter connecting the eastern part of the Salzkammergut with the central Klagenfurt Basin via the Lungau. Only the areas of the Carinthian and the Salzkammergut lakes that are mainly visited in summer are regions of high



Map 2 Tourism in Austria. A multivariate analysis of communes. Factor 2 = the importance of the winter season

intensity. In the east of Austria there are, moreover, a few areas that could preserve some of their former importance in tourism, namely the traditional holiday areas of the Vienna population in the Lower Austrian Limestone Alps, around the Semmering and Wechsel, in connection with short holidays and second homes, and there is some development in the Lake Neusiedl area.

Map 2 depicts the seasonality factor in which the importance of the winter season prevails. Naturally the high-alpine mountain regions particularly well suited for skiing and well equipped with funicular railways and ski-lifts show highest loadings. There are a number of "winter tourism regions", mostly high up in alpine valleys or around passes, e.g. on the Arlberg, in the Montafon, Paznaun and Samnaun, in the region of the Ötztal, Stubai, Tux and Zillertal Alp, in the Hohe Tauern, the Kitzbühel Alps and in the Pongau. The eastern and southern outliers are to be found in the Radstadt Tauern, the Lungau and the upper Enns valley. Further east only a few places have succeeded in gaining some importance as skiing resorts, e.g. Hinterstoder,or Annaberg. Other communes further east and north owe fairly high loadings to being central places or spas. Interestingly enough, only regions on the northern flank of the Alps show some dynamics as to winter tourism.

Map 3 is devoted to the external effects brought about by a high proportion of foreign guests. But for a few individual locations there is a marked west-east gradient to be observed.

Early in the seventies E. LICHTENBERGER had described a "frontier of the area of foreign tourists".[1] The then postulated eastward movement has long since come to a standstill. In central Austria, where the dynamics had been based on a marked proportion of foreigners among the tourists, communes now suffer from a decrease in the share of the market in foreign countries. Therefore, the expansion model of foreigners' tourism ought to be replaced by a regression model.

4. TYPOLOGY OF TOURISM COMMUNES. RESULTS OF A CLUSTER ANALYSIS

For arriving at a typology of tourism communes the variables introduced into the factor analysis were also used in a non-hierarchical cluster analysis (BMDP PKM K-means clustering of cases). *Table 3* presents the results of this analysis.

The intensity of tourism proved to be the basic dimension here as well as in the factor analysis. Thus, four groups of communes were defined. As opposed to factor analysis, here

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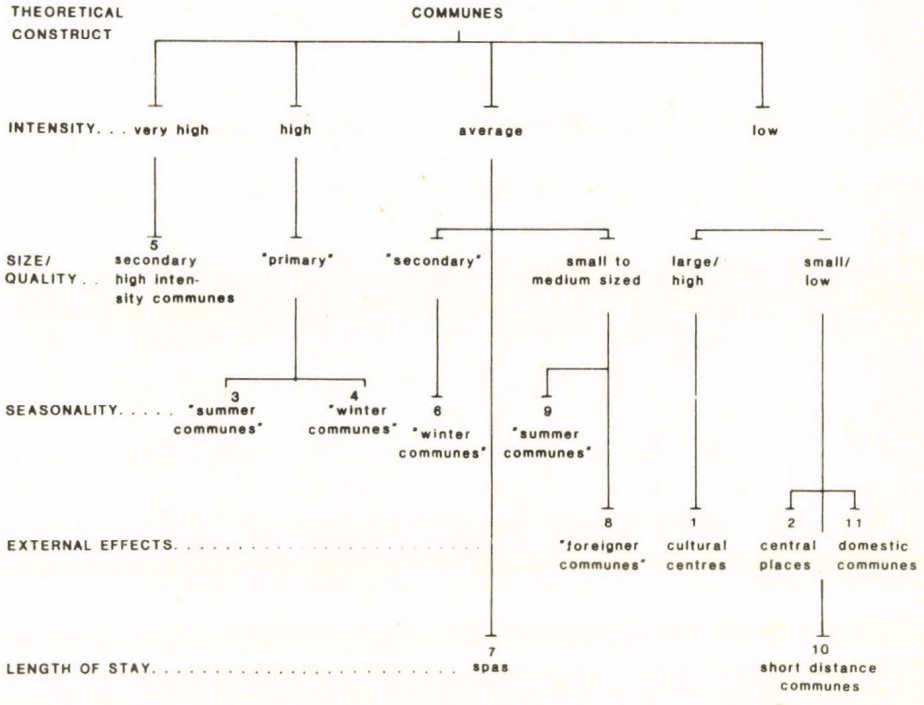
[1] LICHTENBERGER E. (1976): Massentourism als dynamisches System: Das Österreichische Beispiel. In: Tagungsberichte und wissenschaftliche Abhandlungen des 40. Deutschen Geographentages, Innsbruck 1975. Wiesbaden, p. 673-692.

Map 3 Tourism in Austria. A multivariate analysis of communes. Factor 4 = degree of external effects: proportion of foreign guests

Table 3 Dendrogram of a typology of Austrian tourism communes



size and quality combined to form a new dimension. In a further step the seasonality brought a differentiation of summer and winter resorts in the dendrogram. Interestingly enough the amount of external effects with respect to the spectrum of guests brought about a further differentation especially with the communes of low intensity (cf. *Map 4*).

The length of stay was of some significance only with the extreme types of spas and "short-holiday-communes". Surprisingly enough neither the commercialization nor the trend factor is apparent in the cluster analysis dendrogram.

There are 11 types of tourism communes altogether. Their spatial distribution is presented in map 4. The most important features seem to be the differentation of "primary and secondary tourism communes" and the isolation of cultural centres, central places and "short-holiday-communes" in the vicinity of large cities.

In western Austria, "primary winter tourism communes", such as Lech, St. Anton, Kitzbühel, as well as those that are spas at the same time, e.g. Bad Kleinkirchheim, Bad Gastein etc., play an important role. In addition to them there are a number

Map 4 Tourism of Austria. A typology of communes based on a cluster analysis

of "secondary winter tourism comunes" that carry weight and must not be considered just reserves to fall back on. They are augmented by many small and medium-sized resorts with a fair proportion of foreign guests, especially in the Pongau, Lungau and in the Gurktal Alps. There are a few "primary summer resorts" in Carinthia and in the Salzkammergut, but no "secondary" ones exist. The former, as a rule, are surrounded by small to medium-sized resorts at greater distances from the lakes.

Towards the east, the intensity tends to decrease. Small to medium-sized resorts and spas, mainly visited by Austrians, dominate. Moreover the central places stand out as well as the densely settled areas along the main traffic axes and around the cities of Vienna and Salzburg.

Lichtenberger, E.--Pécsi, M. (eds.)
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Studies in Geography in Hungary, 22
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TYPES OF RURAL SETTLEMENTS IN HUNGARY

by

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SUMMARY

During the first two or three decades after the Second World War the development of settlement structures was influenced first of all, by the "socio-economic macro-process" and by the government's concepts and decisions (like, e.g., the land reform, the collectivization of agriculture, the industrialization of the country etc.).

The process of forming the settlement structure between 1950-1980 and their consequences were as follows:

- The development process was directed centrally ("top down"), from "outside".
- There was an effort to homogenize or standardize the settlement structure,
- consequently, local factors, peculiarities, traditions etc., became insignificant.

Settlement geography as well as methodologically oriented institutions tended to choose their research themes according to this development.

Until recently urban geography preferred nation-wide, deductive, "sectoral" types investigations to empirical surveys, partly based on field research. This trend was characteristic of attempts at classifying or typifying villages, too. For showing the basic differences until the 1970-ies it was enough to depict functional-economic differences, the employment-structure of the population, or the rate of urbanization. The methodologically new approach in our investigations is to include as many differentiating factors as possible. We were stimulated to do so by a fact recognized already in the 70-ies, namely that beside the economic aspects and the employment structure reflecting it, there are many more factors that cause marked differences between the villages (e.g. the size of settlement, the demographic process, the infrastructure as to schools and traffic, etc...).

The following 9 factor-groups were taken into consideration during our investigations:

1. physical conditions,
2. the position of a village within the settlement-structure (the size of the settlement, the ratio of scattered settlements, etc.),
3. economic aspects (including the employment structure),

4. the existence of primary and secondary schools,
5. the dynamics of settlement,
6. the accessibility,
7. the man-made physical structure,
8. the "development rate" of the villages.

We used 27 variables in these 8 factor-groups in factor and cluster analyses. Thus 7 main types of villages were found:

I. Small rural settlements with a decreasing number of inhabitants, with unfavourable living conditions and a lack of primary and secondary schools, having mainly agrarian functions.
II. Medium-sized villages with traditional rural functions and agrarian-type employment structure.
III. Large and even huge villages with 5-15,000 inhabitants, working partly in agriculture or having other jobs, with decreasing or stagnant population.
IV. Rural communes, with partly urban-type functions, their population working in industry and in the tertiary sector.
V. Dynamically developing industrial communes in an urban man-made environment.
VI. The communes within agglomerations, residential zones.
VII. Communes with special functions
   a) tourism/holiday communes
   b) communes of rail-workers

ZUSAMMENFASSUNG

Zwei oder drei Jahrzehnte lang wurde nach dem 2. Weltkrieg die Entwicklung bzw. Veränderung des Siedlungsnetzes vor allem durch die gesellschaftlich-wirtschaftlichen "Makroprozesse" sowie durch zentrale Entscheidungen beeinflußt (z.B. Bodenreform, Kollektivierung der Landwirtschaft, Industrialisierung des Landes usw.).

Die siedlungsgestaltenden Prozesse der Periode zwischen 1950 und 1980 und deren Folgen können wie folgt charakterisiert werden:

- Die Prozesse wurden überwiegend von oben (im Hinblick auf das Siedlungsnetz von außen) gesteuert.
- Die Homogenisierung und Uniformisierung des Siedlungsnetzes wurde bewußt oder unbewußt angestrebt,
- infolgedessen wurden die regionalen Faktoren, Eigentümlichkeiten und Traditionen in den Hintergrund gedrängt.
- Derartigen Entwicklungen und Eigenheiten der Siedlungspolitik entsprachen in Ungarn die Themenwahl und der Apparat der Siedlungsgeographie. Sie hat - bis zur jüngsten Vergangenheit herauf - die in kleinen Maßstäben arbeitenden deduktiven, sektionsartigen Untersuchungen den empirischen, sich (auch) auf Geländearbeit stützenden Forschungen gegenüber bevorzugt. Diese Forschungsrichtlinie charakterisierte auch die Versuche zur Dorftypisierung. Bis zu den 70-er Jahren schien in Ungarn die Erfassung und Typisierung der wirtschaftlich - funktionalen Unterschiede der Dörfer, der Berufsstruktur der Bevölkerung oder des Grades der Urbanisierung ausreichend zu sein, grundlegende Unterschiede zwischen den einzelnen Dörfern nachzuweisen. Die methodische Neuerung unserer Untersuchungsweise besteht gerade darin, daß immer mehr der differenzierenden Faktoren in die Forschungsarbeit miteinbezogen wurden. Stark motivierend wirkte dabei, was in den 70-er Jahren offensichtlich geworden ist: Neben dem wirtschaftlichen Aspekt, widergespiegelt durch die Berufsstruktur,verursachen immer mehr Faktoren (z.B. Siedlungsgröße, demographische Prozesse, niedriger Stand des Grundschulsystems, Verkehrslage usw.) bedeutende Differenzen zwischen den einzelnen Dörfern.

Im Laufe der Untersuchungen wurden 8 Faktorengruppen berücksichtigt:

1. Natürliche Umgebung
2. Lage der Dörfer innerhalb des Siedlungsnetzes (Siedlungsgröße, Anteil der Streusiedlungen)
3. Wirtschaftliche Aspekte (Berufsstruktur)

4. Entwicklungsgrad des Grundschulnetzes
5. Dynamik der Siedlungen
6. Verkehrslage, -möglichkeiten
7. Niveau der baulichen Struktur
8. "Entwicklungsgrad" der Dörfer.

In den 8 Faktorengruppen wurden 27 Datensets verwendet. Mit den Daten wurden eine Faktoren- und eine Clusteranalyse durchgeführt. 7 Haupttypen von Dörfern konnten erfaßt werden:

I. Zwerg- und Kleindörfer mit abnehmender Einwohnerzahl, ungünstigen Lebensverhältnissen, Mangel an Grundschuleinrichtungen, überwiegend mit Agrarfunktionen
II. Mittelgroße Dörfer mit traditionellen Dorffunktionen, agrarorientierter Berufsstruktur
III. Groß- und Riesendörfer (5000 bis 15 000 Einwohner) mit agrar-gemischter Berufsstruktur, sinkender oder stagnierender Einwohnerzahl
IV. Gemeinden mit zum Teil städtischen Funktionen, tertiär-industrieller Berufsstruktur
V. Gewerbegemeinden mit dynamischen Entwicklungszügen, städtischen Umgebungen
VI. Agglomerationen, Gemeinden in Wohnzonen
VII. Gemeinden mit speziellen Funktionen
  a) Erholungsgemeinden
  b) Bahnarbeiter-Gemeinden.

* * *

1. INTRODUCTION

Attempts at typifying rural settlements try to describe the most characteristic processes of a given time shaping settlements as well as the factors causing differences among rural settlements. Therefore, the basic aspects of typifying change from time to time.

In pre-war Hungary as many as 95 to 97 per cent of the rural settlements were of a marked agrarian character (in 1949, 53.8 per cent of all wage-earners were engaged in agriculture). The factors mentioned below made it almost impossible for commodity production to become general and for agricultural farms to be modernized: unfavourable conditions of land ownership (besides large estates of feudal origin and character there were numerous small farms that were not viable without extra incomes); industrialization in Hungary made slow progress only; there was a high rate of unemployment in agriculture and the agricultural labour force was partly utilized only. This caused a very slow modernization of the "village" itself. The standard of living was poor, and the level of rural infrastructure was low in comparison to most other European countries; 80 per cent of the flats had one room only; 71 per cent of them had not been built of solid building materials; more than one half of the rural population did not finish the six years of elementary school even that were compulsory at that time. As a consequence of the very slow modernization, the rural population lived in "traditional peasant communities" (36 to 38 per cent of the population - including hired men, farm hands, holders of dwarf farms - had incomes below the level of poverty).

2. SOME PREVIOUS RESULTS OF THE INVESTIGATION OF RURAL SETTLEMENTS

Half a century ago, in Hungary agriculture and the "village" (the majority of the rural population were engaged in agricultural production, and the financial circumstances of living were determined by the conditions of land ownership and the standard of agricultural production; at the same time, the production profile defined the nature of villages etc.) were closely connected. Therefore, research into settlements had to determine the differentiating factors needed to typify rural settlements *within* the scope of agrarian activities. These efforts allowed a classification of rural settlements on the basis of the conditions of land ownership, and the stratification of the peasant society. In the interwar period, in Hungarian scientific literature Ferenc ERDEI (1974) provided the most important contribution regarding the typology of rural settlements. Because settlement geography, which became an independent field of study at the turn of this century, took into consideration those elements of landscape and morphology accepted as important all over the world at that time, the first typologies with respect to *geographical* aspects were prepared by means of comparing the outlay of the fields, the system of field division, topographic situation etc. In the late twenties Gyula PRINZ (1922) determined types of rural settlements on the basis of ground plans using topographic maps. This kind of typology reflected the effects and findings of German settlement geography.

During the late 1940s, the rural settlements in Hungary were no longer of predominantly agrarian character. As a consequence of rapid and forced industrialization (with almost all of the resources of the country being invested into industry), launched in 1948-1949, industrial and mining villages were established in large number, and the exodus from agriculture was followed by commuting to industrial workplaces. (This exodus was accelerated by collectivization efforts and discrimination againts agriculture, too.) Although employment restratification of the rural settlements was rapid in the 1950s and 1960s, it did not cover all the regions of the country. Differences among rural settlements were brought about mainly by the locational ties of the individual settlements with industrialized regions and industrial centres, the extent of the employment restratification, and the changes in functions and economic activities. The differences in the role played by commuting, in the extent of the employment restratification and the changes in economic functions was decisive for the circumstances of daily life in,and the development potentialities of, rural communities. The growth in the number and ratio of wage-earners not employed in agriculture was followed by a disintegration of the formerly traditionally agrarian communities. The incomes won at industrial workplaces exceeded those of agriculture by far. Centralized national settlement development plans (promoting public sector housing construction, improving infrastructure, and securing the provision of a wide range of goods etc.) favoured industrial and mining villages. As a result of commuting, the features

of an "urban way of life" were also brought into rural settlements. All this was reflected by demographic processes, the migration patterns, the standard of supply, and also in settlement morphology.

Since World War II, the development of the settlement network has been influenced, first of all, by socio-economic "macro"-processes, central (governmental) plans and decisions (e.g. land reform, collectivization of agrfculture, industrialization, directives of planned economy). This might explain why local factors, facilities, and pecularities of specific societies lost importance, due to this almost complete abolishment of self-government of rural settlements. The transformation of both the settlements and the settlement network was extremely rapid and massive at that time. This "metamorphosis" relied on different sources: on a fundamental change in social relations and terms of ownership; on the modernization of the means of production, and on a radical change in social institution etc. In Hungary the transition from an agrarian society to an industrialized one lasted only one and a half or two decades whereas in Western and Northern Europe this process took one or two centuries. This rapid rate of change influenced the nature of the processes of transformation: An unusually rapid out-migration was expressed not only in the decrease of the rural population, but also in a socio-demographic distortion of the local societies, and a disintegration of the micro-societies (families, neighbourhoods, local communities) (ANDORKA, R. 1979).

Thus, the settlement shaping processes and their consequences in the period between 1950 and 1980 can be described as follows:

- the processes were largely directed "from the top" (from the point of view of settlement network: "from outside");
- both the planned and the spontaneous efforts made the settlement network become homogeneous and uniform;
- as a result, local factors, pecularities, and traditions lost importance.

Both the development of the settlement network and regional planning have also reflected these characteristics as the distribution of means for development *was organized centrally*, applying the same development patterns all over the country.

The selection of subjects and methods for settlement geography corresponded to these characteristics of settlement development and settlement policy. Until quite recently, settlement geography concentrated on nationwide deductive investigation and did not do any field work. This type of research was typical for rural geography as well. Until the 1970s, the basic differences among rural settlements were determined with respect to their economic functions, the occupational structure of the population or the extent of urbanizatin; it must be stressed, however, that only one or two factors were used to determine the position of rural settlement in the settlement system. Edit LETTRICH (1965) distinguished different types of settlements on the basis of the occupational structure of the residential population; in her opinion, these settlement types "reflect the level of urbanization which appeared in the employment structure of the residential population". The types found were as follows: *agrarian, mixed* and *urbanized* villages.

In the middle of the 1960s the author of this paper made an attempt to typify the rural settlements of Hungary on the basis of data on the occupational structure, the extent of commuting, and certain special functions. The following types were determined: villages with *agrarian, industrial, residential, special* (such as recreational or "railwaymen"-villages), and *mixed functions* (BELUSZKY, P. 1965).

3. METHOD OF INVESTIGATION

The present paper represents research of the latter type which is a novelty in Hungarian scientific literature as regards its conception and methodology because instead of only one or two aspects used in earlier typologies there are a great many differentiating factors now. Variations in settlement size, demographic processes, the development of the basic administrative network, transport characteristics etc. - made such a great number of differentiating factors necessary in the 1970s.

The eight groups of factors investigated were as follows:

- Natural environment;
- The position of a rural settlement in the settlement system;
- Economic functions (occupational structure, commuting);
- The development level of basic institutions;
- Trend and dynamism of settlement development;
- Communications;
- Built environment, and quality of flats;
- Standard of general development of the rural settlement.

These eight aspects were quantified by means of 27 indices. The data available allowed for the application of factor- and cluster analyses resulting in supporting a hypothesis of the author regarding the continuously diminishing contribution of the occupational structure (or economic functions of settlements) to the emergence of substantial differences among rural settlements. There are *13 factors* representing the basic differences best:

Factor F_1 represents the standard of existing basic institutions and settlement development; it characterizes the settlement structure and communication networks. The elements of this factor play a decisive role in the shaping processes and differences among rural settlement.

Factor F_2 involves indices of the occupational structure and of commuting emphasizing economic characteristics of decreasing importance in differentiating rural settlements. In regions of hamlets, the occupational structure is less important than physical features or the size of settlements.

Factor F_3 represents the dynamism of settlement development and the rate of housing constructions.

Factor F_4 involves the characteristics of the natural environment which influence the lives of the inhabitants and settlements.

Factor F_5 represents the ratio of population living in scattered farmsteads and the consequences of this settlement structure, e.g. low level of technical infrastructure.

Factor F_6 contains indices of the occupational restratification.

Factor F_7 represents transport characteristics that play an important role in daily life.

Factor F_8 consists of indices of tourism, while *Factor* F_9 contains the size of the residential population. *Factor* F_{10} represents the rate of population change, and *Factor* F_{11} shows the ratio of workers employed in the tertiary sector.

Factor F_{12} demonstrates the changes in infrastructural supply and amenities as well as in actual population size. Finally, *Factor* F_{13} includes the percentage of the not gainfully employed.

4. RESULTS OF INVESTIGATION

The factor scores for the units of investigation (rural settlements) constituted the data base for cluster analyses. A variant involving 25 clusters was considered suitable for identifying clusters with well-defined differences between them. The 25 clusters were divided into seven principal types as follows (see map at the end of volume):

1. Small-sized villages and hamlets with decreasing population, lacking a basic institutional network, performing mainly agrarian functions

This first major type includes 1,090 settlements, i.e. one-third of all the rural settlements of Hungary(there are, however, 1,585 rural settlements with a population below 1,000). These settlements are characteristic of the so-called "small-village phenomenon". Small-sized villages have a decreasing population and uncertain prospects for their future. In the mid-1960s, rapid out-migration started, sometimes causing a complete depopulation and administrative abolishment of small communes. This exodus has deformed the demographic structure of the population. A high proportion of the inhabitants belongs to the older, unskilled population with low incomes. The numbers of deaths exceeds that of births. The unfavourable demographic processes seem to be irreversible. Despite the present settlement policy the future of these small-sized rural settlements is uncertain. Most small villages are situated in the hilly and mountainous regions in the counties Baranya, Zala, Vas, Borsod-Abaúj-Zemplén, and Szatmár (BELUSZKY, P.-SIKOS, T.T. 1981). (see clusters 21, 5, 16, 22, 20 and 8).

II. Medium-sized rural settlements with traditional rural functions with an agrarian employment structure

Approximately 800 rural settlements belong to this type. An important feature consists in the fact that their position in the settlement network and their economic functions have hardly changed during the past decades. The settlement shaping processes in these settlements are free from "demographic erosion", they have no significant in-migraton, and no substantial rural industrialization. At present, these settlements are independent units within the settlement network that did not establish hierarchical contacts with neighbouring rural settlements. Two-thirds of the wage-earners have an agrarian occupation. A special subtype is constituted by farmstead settlements where a significant part of population continues to live (see clusters 6, 11, 9, 12, 15, 4 and 17).

III. Large-sized and giant rural settlements with agrarian and mixed employment structure and a decreasing or stagnating population

With these settlements, the size can be said to be "urban", and the population size can reach or even 10,000, still they perform rural functions and their social structur is also rural. The overwhelming majority of these large and giant villages are situated in the Great Hungarian Plain (see clusters 3 and 13).

IV. Rural settlements having a tertiary and industrial occupational structure and performing urban functions

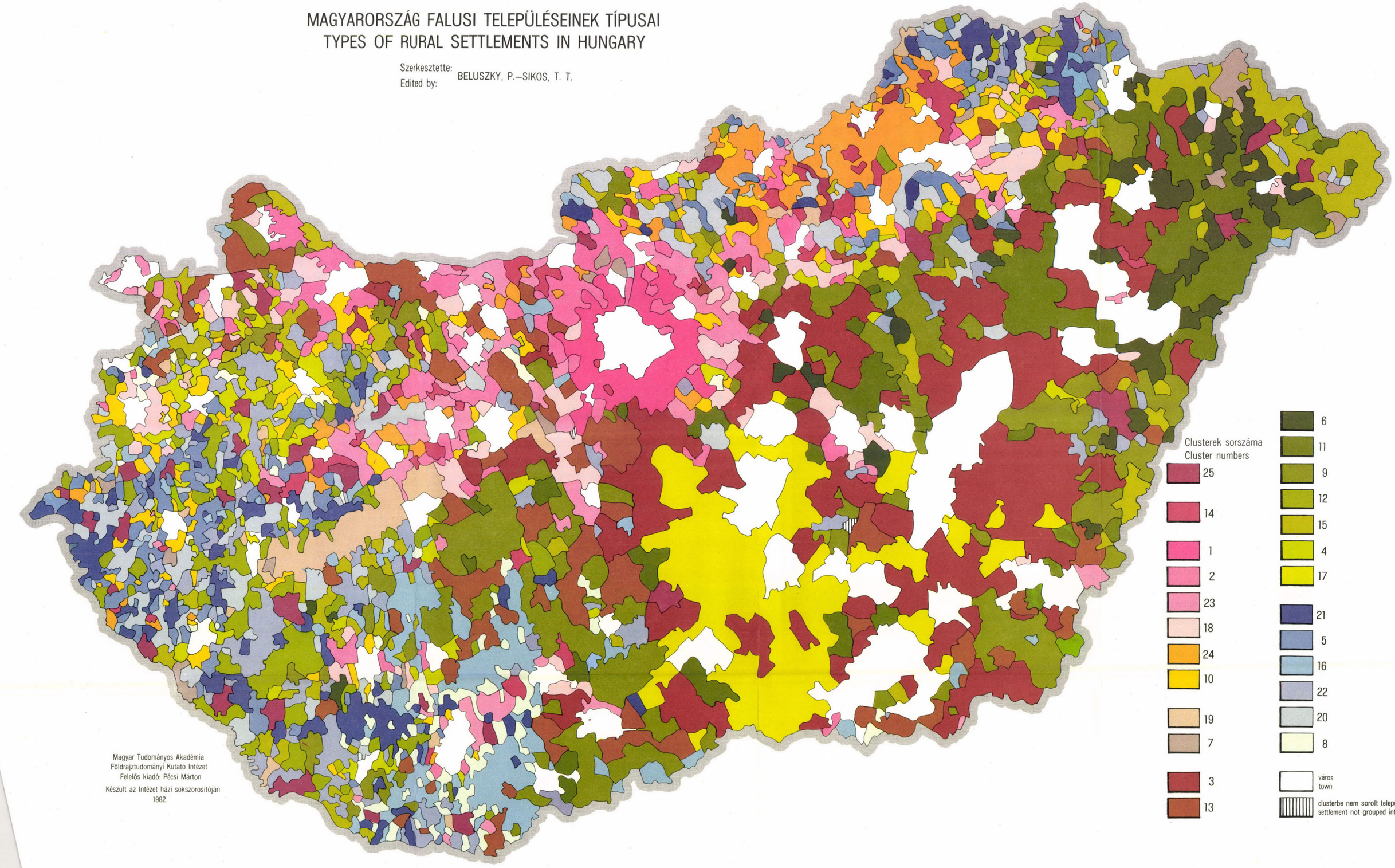
These settlements are situated at urban-rural fringes. During the investigation their legal status was that of village (since then, some of them have been designated towns). These villages have urban functions, and as a result of extensive industrial activities and favourable transport facilities they have an increasing population and show significant growth (see cluster 25).

V. Industrial rural settlements with dynamic development which are situated in urban structures

The way of life in these settlements with about 4,000 inhabitants has been determined by industry of national importance, the one-sided industrial occupational structure, and the emergence of manufacturing industry during the past decades. Their enormous dynamism and rapid population growth were promoted by central settlement planning, too (including public housing constructions, infrastructure development etc.) (see cluster 14).

MAGYARORSZÁG FALUSI TELEPÜLÉSEINEK TÍPUSAI
TYPES OF RURAL SETTLEMENTS IN HUNGARY

Szerkesztette:
Edited by: BELUSZKY, P.–SIKOS, T. T.



Magyar Tudományos Akadémia
Földrajztudományi Kutató Intézet
Felelős kiadó: Pécsi Márton
Készült az Intézet házi sokszorosítóján
1982

VI. Rural settlements within agglomerations and and residential zones

About one-third of the Hungarian villages is characterized by substantial occupational restratification (only 20 per cent of the wage-earners of these settlements have an agrarian occupation) and by a high rate of out-commuting (58 per cent on an average). As this process is a relatively new one (it dates back to the interwar period only in the settlements of the Budapest agglomeration; as regards the other regions, the process of agglomeration became a general one only in the 1960s), it has greatly varying effects on the transformation of settlements The process of actual agglomeration is characteristic of a small part of these villages amounting to some 48-50 settlements in the surroundings of the capital. In the eastern part of Budapest agglomeration, villages have had a long agrarian-rural past; the majority of in-migrants arrived from distant and backward agrarian regions of the country; this is why a rural way of life, a typically rural value system and a small-scale agrarian production are still progressing at present. (Public administration tends to designate settlements within agglomeration to parts of towns thus diminishing the extent of agglomerations. Since 1970, the status of 101 rural settlements has changed in such a way.) The number of residential rural settlements has grown with a high rate of out-commuters, still the transformation of these settlements is in its initial stage. The population of residential villages with unfavourable agrarian endowment and small population size decreased rapidly (e.g. at the fringe of an industrial region situated between Ózd and Miskolc, North-Hungary), and the circumstances of daily life have been unfavourable (see clusters 1, 2, 23, 18, 24 and 10).

VII. Rural settlements possessing special functions

About 50 rural settlements in Hungary have *recreational* functions. Two-thirds of them are situated along Lake Balaton. One half of the wage-earners are employed in the tertiary sector. Some of these settlements were originally established as summer resorts (Balatonföldvár, Balatonfenyves, Balatonvilágos etc.) but resort villages that had been agrarian villages formerly have also undergone a substantial metamorphosis. The seasonal nature of recreational functions is characteristic of everyday life in these settlements. Despite certain similarities, each resort settlement possesses an individual character that is informed by dissimilarities as to the natural environment, the differences in tourist functions, the traditions of recreational functions, the nature of supplementary functions etc.

There are about 40 "railwaymen-villages" and a few rural settlements of peculiar nature such as Beloiannis, a "barrack"-village of Greek refugees who had settled in Hungary at the end of the 1940s (see clusters 19 and 7).

5. CONCLUSIONS

As was mentioned earlier, a settlement typology is suitable for revealing nationwide processes. It must be noted, however, that since the late-1970s, new tendencies have appeared in the development of rural settlements in Hungary. There has been a tendency to stress the importance of pecularities, special traditions and local resources of the settlements, and appreciate the efforts and ambitions of their populations. This phenomenon is evident to such a degree that regional and settlement development must take it into account. This change has its roots in social and economic developments. The spatial structure of the country and the allocation of production have been determined, the occupational structure has become stable, changes in the employment structure have slowed down, especially within the cohorts. The inhabitants' "social positions" became fixed (which, sometimes, leads to socially undesirable phenomena, such as the emergence of social advantages or disadvantages). It is mainly the "second economy" that constitutes the field for individual ambitions and mobility. The attraction of higher routes of workplaces and in the residential hierarchy diminished. Regional mobility, especially the extent of interregional migration, decreased, thus leading to a more moderate "disintegration" of local societies. The importance of employment as a differentiating factor between settlements decreased which is due partly to equal income levels etc.

A great many politico-economic and socio-political goals and tendencies have become obvious and fixed by now (e.g. the long-lasting flourishing of part-time farming, its integration into large-scale agricultural farming, the means and ways of housing construction etc.) They can provide a basis for families and individuals to make their own decisions, thus contributing to a settlement development that is largely influenced by the consequences of "long-term strategies" of the different social strata and local communities (such as alternative ways of living in the native settlements or of letting younger generations migrate to towns; decisions made in the field of education or at certain stages of the lifepaths or in using incomes etc.) (KULCSÁR, K. 1982).

In addition, the framework of settlement development directed from "outside" is changing, including public administration (increasing independence, wide scope for self-government and possibilities for more independent financial management of local councils), settlement policy, and the strengthening of the tendency to rely on population resources which involves a more intensive participation in local affairs. Accordingly the future of settlements in Hungary can take various forms and the development directions cannot be predicted in a deductive way. The processes emerging in settlements should be revealed as precisely as possible; this is a requirement for effective settlement development planning, too. There has been a growing need for empirical research and its ratio within investigations is about to increase. The author of this paper considers it important to set up a so-called "Settlement Monitoring System" aiming at registering settlement forming processes and the pecularities

of the development of local societies in (rural) *settlements of different types*, applying the same aspects and methods of observation, *continuously*. The results of investigations carried out in 18 to 20 settlements in Hungary will form a data base. It is intended *to make* studies at regular intervals starting in 1987.

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MATHEMATICAL AND GEOGRAPHICAL INVESTIGATIONS OF SOCIAL INFRASTRUCTURE IN RURAL SETTLEMENTS OF BORSOD-ABAÚJ-ZEMPLÉN COUNTY

by

Tamás T. SIKOS

SUMMARY

At present the problem of the infrastructure level of the settlements in Hungary is at the very centre of scientific interest. It has been verified that as from the 1970ies the infrastructural level of a settlement has determinded both the amount of migration and the tempo of housing development to a large extent. It can influence the decision as to the changing of the working-place and the development of settlements or the settlement pattern.

There are unfavourable processes in this field, too, e.g. a quick population loss of some rural settlements, the depopulation even of some villages, an overcrowding of some others, etc. Understandably there were discussions about the establishment of the basic facilities and about an equal distribution of technical infrastructure on a regional level.

The aim of this paper is to examine the spatial differences that can be found in the level of infrastructure in the rural settlements of Borsod-Abaúj-Zemplén county.

As a result of these investigations the following statements can be made for the 352 rural settlements of the county. More than 40% of them have an infrastructure being in the initial stage of development. Another 40% have a weakly developed infrastructure associated with medium rate public facilities. Only 17% of the rural settlements have medium to better infrastructure, and only 10 dynamically developing settlements can be said to have a suburban type of infrastructure (that is less than 3%).

The study proved the important role of the transport network in developing infrastructure in the case of rural settlements.

The series of maps and the mathematical methods used make it possible to indicate those areas, in which rural settlements which are weakly developed and have lower-level facilities only are most frequent. They are mainly the settlements of the Cserehát Range, the karst areas of Northern Borsod, the Bodrogköz, the Bükk Mountains and the Borsod-Mezőség. We believe that the methodological progress of our work lies in exploring the meaning of the rotated factors and presenting those factors that play leading roles in the formation of a developed infrastructure. (F_1 = the development level of basic facilities, F_2 = the dynamics and quality of housing construction, F_3 = communication level, F_4 = unfavourable residential and communal conditions)

The Borsod-Abaúj-Zemplén county, as a model-area, showed that factor and cluster analyses are suitable for typifying the residental facilities in Hungary or other counties, after making some modifications in the data-bank.

ZUSAMMENFASSUNG

In Ungarn gelangte die infrastrukturelle Versorgung der Siedlungen in den Mittelpunkt des wissenschaftlichen Interesses. Es erwies sich, daß das Niveau der infrastrukturellen Versorgung - besonders von den 70-er Jahren an - das Tempo der Abwanderung der Bevölkerung, und des Wohnungsbaus bestimmt, zum Arbeitsplatzwechsel motivieren kann und letzten Endes auf die Entwicklung der Siedlungen wie des Siedlungsnetzes einen bedeutenden Einfluß ausübt.

In diesem Zusammenhang sind auch ungünstige Prozesse festzustellen (rascher Bevölkerungsverlust in einigen Dorfsiedlungen, Entvölkerung einiger Dörfer, zu hohe Dichte in anderen). Es ist daher durchaus verständlich, daß im Rahmen der Siedlungspolitik in den vergangenen Jahren dem Entwicklungsgrad des Grundnetzes an Einrichtungen und dem regionalen Ausgleich bezüglich der technischen Infrastruktur besonderes viel Augenmerk geschenkt wurde.

Als Ergebnis der Forschungen konnte für 352 Dörfer des Komitates Borsod-Abauj-Zemplén folgendes festgestelit werden: Über 40 % der Dorfsiedlungen des Komitates verfügen nur über eine Infrastruktur, die in die Anfangsperiode der Entwicklung einzuordnen ist. Etwa 40 % der Siedlungen weisen eine schwach entwickelte Infrastruktur auf, wozu eine mittelmäßige Ausstattung mit öffentlichen Einrichtungen gehört. Bloß 17 % der Dorfsiedlungen haben eine mittelmäßige bzw. entwickelte Infrastruktur, 10 dynamisch entwickelte Siedlungen (weniger als 3 %) haben eine vorstadtmäßige Infrastruktur.

Die Forschung hat die besondere Bedeutung des Verkehrsnetzes für die Entwicklung der Infrastruktur der Dorfsiedlungen bewiesen.

Mit Hilfe von Kartenserien und mathematischen Methoden sind jene Gebiete leicht zu bestimmen in denen Siedlungen mit schwach entwickelter und rückständiger Infrastruktur dicht gehäuft sind. Diese Regionen sind das Gebirge Cserehát, das Karst-Gebiet im Norden, das Zemplén-Gebirge, Hegyköz, Bodrogköz, das Bükk-Gebirge und Borsodi-Mezőség. Die methodische Bedeutung der Arbeit besteht darin, daß die Aussagefähigkeit der rotierten Faktoren bestimmt wird, ferner daß angegeben wird, welche Faktoren eine führende Rolle in der Entwicklung der Infrastruktur haben (z.B. F_1 = Entwicklungsgrad der Grundelemente der Dienstleistungen, F_2 = Dynamik und Austattung des Wohnungsbaus, F_3 = Verkehrslage, F_4 = ungüngstige Wohnungs- und Kommunalfaktoren).

Der Versuch im Modellgebiet im Komitat Borsod-Abauj-Zemplén hat erwiesen, daß die Faktoren- und Clusteranalyse nach gewissen Änderungen in der Datenbank auch für die Erstellung einer Typologie der Infrastrukturausstattung für ganz Ungarn und für andere Komitate anwendbar ist.

* * *

INTRODUCTION

During the past 40 years of socialist development, the goals of national economy have changed considerably and Hungary was transformed into an industrial-agrarian state. These profound changes resulted in a significant increase in the living standards of the population on the whole. Now, society and social politics are facing the task of dealing with disproportions in regional development as well as in the living standards of urban and rural populations.

At present, regional policy pays particular attention to the development of the infrastructure and settlement network. If social infrastructure and communication networks of rural settlements do not develop properly, undesirable phenomena are likely to arise, leading to an out-migration of population from rural areas, to "demographic deformation" of rural settlements, lacks in the agricultural labour force and the formation of problem regions.

The facts mentioned above are of great importance, therefore they are to be considered interesting topics for geographical research.

Our studies focussed on the different regional levels of social infrastructure in rural settlements of Borsod County which has been chosen as a model region for the reasons given below.

2. THE MAIN AIMS OF THE STUDY

A typology of rural settlements of Hungary was elaborated by the author of this paper and P. Beluszky between 1979 and 1981 (BELUSZKY, P. and SIKOS, T.T. 1982a, 1982b, 1983). It could be shown that almost all types or rural settlements of the whole country can be found in Borsod County. As social infrastructure is a basic element of rural settlement development, this typology could be elaborated for this area. Within the the framework of the topic chosen the following problems were studied:

1. A typology of rural settlements of Borsod County was elaborated, based on a methodological concept differing from earlier ones in the calculation of indices and mathematical and statistical methods applied (BELUSZKY, P. and SIKOS, T.T. 1979).

2. A typology of the social infrastructure of rural settlements resulted from factor- and cluster analyses.

3. A data base was compiled providing information on the social infrastructure of rural settlements of Borsod County from different points of view.

4. Functional relationships between the population of rural settlements and indices of the development levels of the social infrastructure were determined.

5. Using factor analyses, factors were extracted and their contributions to the development of social infrastructure in rural settlements of Borsod County were examined (SIKOS, T.T. 1986).

All the calculations were run on a computer of the type IBM 3031 at the Hungarian Academy of Sciences on the basis of the authors's research program.

A great number studies were published by Hungarian scholars recently, investigating primarily public administration and economic problems as well as the stratification and migration of population in rural settlements. In these studies, attention

was focussed on the differentiation in regional development levels and the typology of rural settlements in Hungary. A complex economic and economic-geographical research into the typology of social infrastructure of rural settlements was, however, not carried out yet. Moreover, the application of methods of factor and cluster analyses in the typology of social infrastructure and rural settlements can be regarded as a new concept.

The statistical data base for 1980 and data collected by the Council of Borsod County were valuable sources for the investigations. Research has been carried out first of all by the application of mathematical methods, it involved, however, comparative methods of economic geography and cartography, too.

The type of social infrastructure was determined for 352 rural settlements of Borsod County by making use of cluster analysis. 13 clusters with a maximum homogenity involving 9 subtypes and 5 main types *(Fig. 1)* were found. They are presented below.

3. MAIN TYPES

"1" - represents social infrastructure in an initial stage of development, containing 3 clusters (11, 6, 12). It comprises 40 percent of rural settlements of Borsod County. Most of them are situated in the Northern Borsod Karst, the Highlands of the Cserehát and Zemplén, in regions of the county lying far away from transport routes. The values for the indices of social infrastructure are much lower than the county mean in this initial stage of development.

"2" - denotes little developed social infrastructure and communication networks of medium level. It includes clusters 10, 13, and 7 which constitute 2 subtypes.

This type of social infrastructure is characteristic of almost 40 percent of the rural settlements in Borsod County. The majority of them are large villages and more developed settlements. In general the second main type shows high value for the indices of transport facilities and values for the indices of public utilities and basic services as high as those of the county means. There are significant difference between these two subtypes in the development level of the basic elements of the services. The complex index of basic services (index 3) amounts to 10 points for cluster 10 while these values are 18 and 20 points resp. in clusters 13 and 17 which means that it exceeds the county mean value considerably.

"3" - denotes averagely developed social infrastructure and comprises clusters 8 and 9, with 14 percent of the rural settlements of Borsod County. These dispersed settlements are situated in the highlands, in the industrialized valley of the Sajó river and in the Miskolc agglomeration. Subtypes 8 and 9 of this main type differ in the development level of the transport

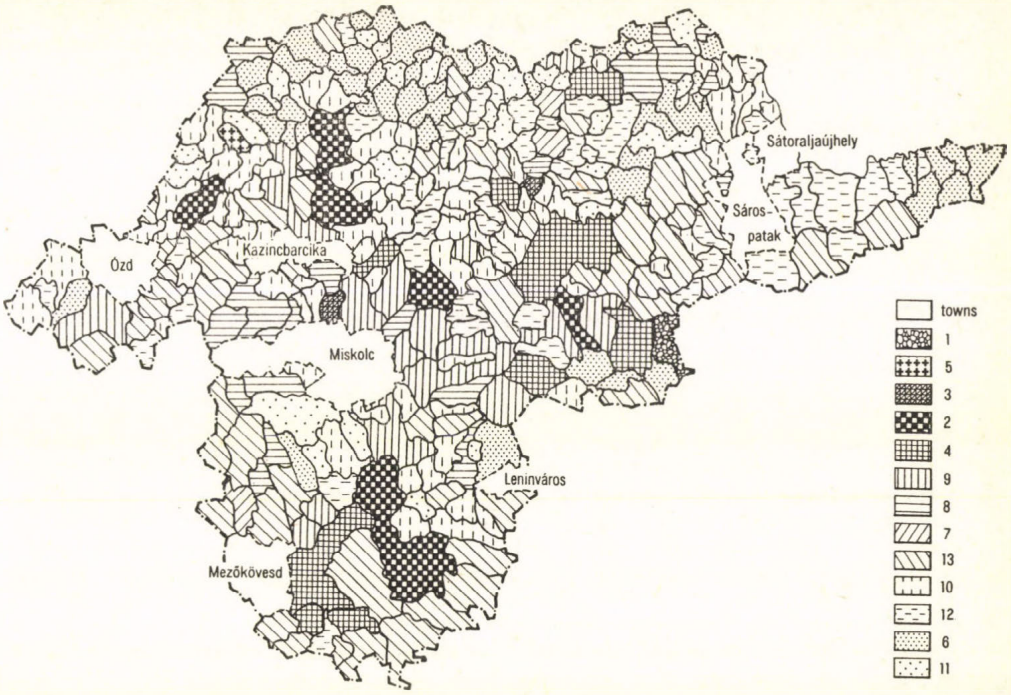

Fig. 1 Types of social infrastructure in rural settlements of Borsod-Abauj-Zemplén County in 1980; clusters 1-13

network and tourist services as well as in the level of basic services.

"4" - shows advanced stage of social infrastructure development and includes 11 rural settlements in Borsod County arranged in a mosaic-like pattern in the territory of the county. The value for the complex index of basic service amounts to 25.5 points which is twice as much as the county mean. Former small towns, such as Abaújszántó, Gönc, Tállya and Tarcal, belong to these rural settlements. The indices of the rate of housing, quality of flats and public utilities are higher than the county mean. The accessibility of the nearest towns and villages (county seats) is quite good, though the frequency of services of mass transport is lower than the mean in the county. Generally speaking the social infrastructure of this main type provides favourable living conditions for the rural population.

"5" - For this main type, social infrastructure corresponds to that of small towns (clusters 2 and 3). 10 rural settlements of the county belong to it. It involves 4 district seats (Edelény, Szerencs, Mezöcsát and Encs) as well as 3 former district seats

(Szikszó, Putnok and Sajószentpéter). Industrial enterprises located in these settlements have a dynamically developing service network. Urban features dominate in the way of life of these settlements. The communication network is well developed. Practically all these settlements are situated along transport routes or not far from then. The social infrastructure of these small towns provides good living conditions for the rural populations which increased 1.5 times during the last 30 years.

In conclusion it is worth mentioning that the indices of the development of social infrastructure frequently exceed the national means. On the other hand research is aware of the fact that in more than 40 percent of the rural settlements of the county social infrastructure is just in an initial stage of development. Moreover, another 40 percent of rural settlements of the county have a badly developed social infrastructure and a public utility network of medium-level only. In only 17 percent of the rural settlements of the county social infrastructure is developed averagely or even in an advanced stage of development, and there are merely 10 dynamically developing rural settlements (less than 3 percent) which can be attributed a social infrastructure of a small towns' type.

The significant role of the transport network in the development of the social infrastructure of rural settlements has been stressed by research findings.

The analysis of map series - reflecting the regional distribution of the indices of the development of social infrastructure - provides a possibility for delimiting regions in which rural settlements having poorly developed or underdeveloped services are accumulated. These settlements are situated mainly in the Cserehát, Northern Borsod Karst, the Highlands of Zemplén and Bükk, Hegyköz, Bodrogköz and Borsodi Mezőség *(Fig. 2)*.

Methodologically, this study is significant mostly for interpreting the information provided by related factors and those facts that can have impacts on the development of social infrastructure. If the data bank for the investigations carried out in Borsod County as a model region is somewhat extended, factor and cluster analyses can be used to elaborate a typology of social infrastructure for either Hungary or other countries.

4. THE MOST IMPORTANT RESULTS

- Types and subtypes as to social infrastructure of rural settlements were determinded.
- Rural settlements and regions having a poorly developed social infrastructure were delimited.
- A data bank covering as many as 200,000 data referring to basic information was compiled and can be applied in other planning tasks.
- A map series has been prepared, illustrating the development of the basic elements of social infrastructure in rural settlements.

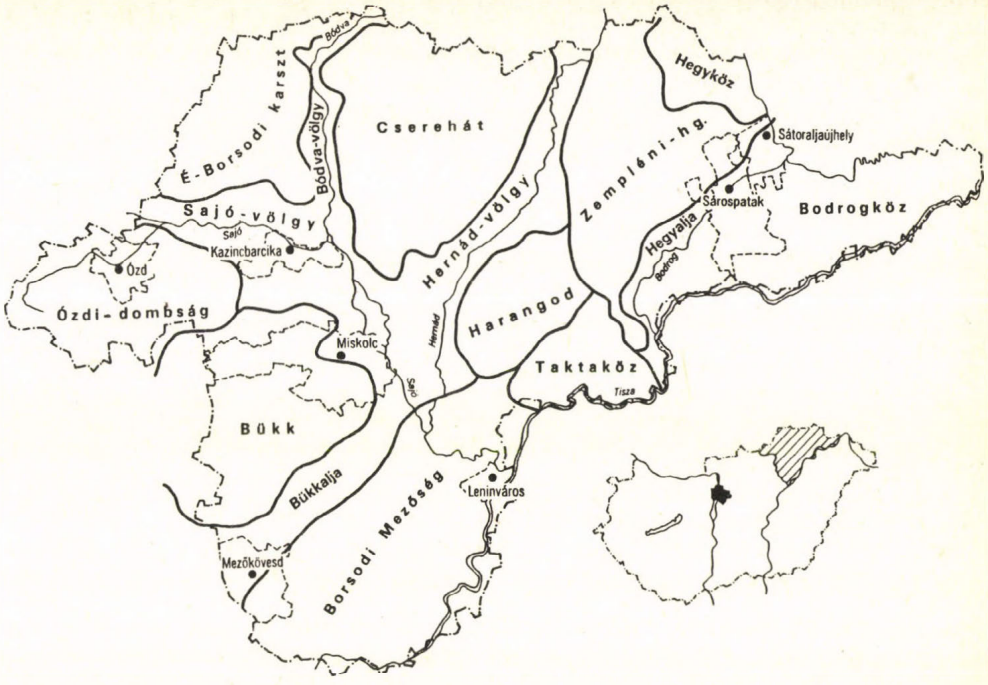

Fig. 2 Geographical units of Borsod-Abaúj-Zemplén county, Hungary

APPENDIX

INDICES FOR THE INVESTIGATION OF TYPES OF SOCIAL INFRASTRUCTURE IN BORSOD-ABAÚJ-ZEMPLÉN-COUNTY

Numerical indices used in the analyses (mean and standard deviation in brackets):

A. *Basic institutions in rural settlements*
1. Size of retail shops in 1979, m^2 (364 m^2; 631 m^2);
2. Per capita value of consumer goods' turnover in retail trade in 1979 (3001,- Ft; 4584,- Ft);
3. Network of basic services in 1980 (12.1 points; 8.0 points);
4. Number of workers in small scale industry in 1979 (11.3 persons, 15.9 persons);
5. Places in nurseries per 100 children of 0-3 years in 1980 (1.3 places, 5.9 places);
6. Places in kindergartens per 100 children of 3-6 years in 1980 (33.5 places, 44.0 places);
7. Number of consulting hours in 1979 (0.9 hrs.; 3.9 hrs.);

B. Characteristics of flats and basic services in rural settlements

8. Proportion of flats built after in 1980 (52.5 percent; 15.9 percent);
9. Proportion of flats built between 1970 and 1979 in 1980 (13.9 percent, 8.5 percent);
10. Proportion of one-room flats in 1980 (26.5 percent; 10.2 percent);
11. Proportion of residential buildings having more than one storey in 1980 (0.3 percent; 1.7 percent);
12. Number of flats with bathrooms or lavatories per 100 flats in 1980 (26.4 percent, 15.3 percent);

C. Provision of rural communities with public utilities

13. Proportion of flats supplied with electricity in 1980 (96.9 percent; 2.9 percent);
14. Proportion of flats with water mains in 1980 (21.7 percent, 14.9 percent);
15. Proportion of flats with gas mains in 1980 (53.3 percent, 14.8 percent);
16. Proportion of flats connected to a sewage system in 1980 (23.9 percent, 15.4 percent);
17. Per capita electricity consumption in 1980 (kwh) (805.8 kwh; 281.2 kwh);

D. Transport network characteristics of rural communities

18. Transport network in 1980 (4.5 points, 2.6 points);
19. Accessibility (in minutes) of nearest town or village (district seat) by most rapid means of transport in 1980 (40.3 min.; 27.4 min.);
20. Frequency of transport to towns in 1980 (81.2/week, 89.2/week);

E Educational and cultural characteristics of rural communities

21. Number of school rooms in elementary schools in 1979 (4.8 school rooms; 6.1 school rooms);
22. Number of pupils in elementary schools in 1979 (153 pupils 228 pupils);
23. Number of students in secondary schools in 1979 (13 students, 147 students);
24. Proportion of those 15 years or older finishing 8 years of elementary school in 1980 (52.0 percent, 8.9 percent);
25. Proportion of those 18 years or older having finished secondary school in 1980 (9.6 percent; 4.3 percent);
26. Number of volumes per libraries in 1979 (3968.4 volumes; 6784.2 volumes).

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Budapest, 1988

AUSTRIAN ALPINE FARMING BETWEEN AGRICULTURE AND TOURISM

by

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SUMMARY

As a consequence of the time-lag of social change the mountain farmers of the Austrian Alps have preserved the traditional agrarian system, for which the pursuit of self-sufficiency is characteristic, remarkably long. In 1958 the proportion of typical mountain farms which were self-sufficient was 23 percent of the total number, that of typical lowland farms was only 7 percent. During the past decades the decrease of the agrarian population has compelled farmers to mechanize more intensively. Apart from a specialization of farms in cattle breeding and dairy farming there is a concentration of agrarian land use on the low-lying locations. This reevaluation of locations is connected with the possibility of using machines: According to studies in Austria the costs of cultivation are three times higher on steep slopes that can only be cultivated by hand than on flat land. As a result of the lower natural productivity and the higher costs of cultivation the mountain regions have become agrarian problem areas, in which the majority of the mountain farmers depend on second, non-agrarian incomes. As they are unable to compete in the fields of trade and industry because of unfavourable conditions, tourism is especially suited to provide second incomes. Whereas the share of tourism in non-agrarian incomes is only 12 per cent on average in Austria, it is 36 percent in the area of the "High Alps" ("Hochalpen"). With the letting of rooms two types can be distinguished. "Holiday tourism" dominates in most regions. Only in the surroundings of big cities - especially of Vienna (Eastern Austria) and Munich (Western Austria) - the farmers gain substantial incomes from full-year rental of second homes to people from those cities. The importance of this rental of rooms shows remarkable discrepancies between East and West. The "tourism farmer" predominates in Western Austria ("Almbauerngebiet"). This type has only slightly spread to the East during the past 20 years. The future prospects for "holidays on the farm" are less favourable than widely assumed. They depend on the touristic demand, above all, which is more stable in the centres of winter sports than in regions where summer tourism dominates.

ZUSAMMENFASSUNG

Infolge der zeitlichen Verzögerung des gesellschaftlichen Wandels hielten die Bergbauern der österreichischen Alpen auffallend lange am traditionellen Agrarsystem fest, welches durch das Streben nach Eigenversorgung gekennzeichnet war. 1958 entfielen bei typischen Bergbauernbetrieben noch 23 Prozent des Rohertrages auf die Eigenversorgung, bei Flachlandbetrieben betrug dieser Anteil hingegen nur noch 7 Prozent. In den letzten Jahrzehnten mußten die bergbäuerlichen Arbeiten infolge des Rückganges der Agrarbevölkerung verstärkt mechanisiert werden. Neben der Spezialisierung der Betriebe auf die Viehwirtschaft kam es zu einer Konzentration der agrarischen Nutzung auf flache Standorte. Dieser Wandel hängt mit der landtechnischen Entwicklung zusammen: Nach österreichischen Untersuchungen sind die Bearbeitungskosten an Steilhängen, die nur in Handarbeit bewirtschaftet werden können, dreimal höher als in der Ebene. Infolge der geringen natürlichen Produktivität und der erhöhten Bearbeitungskosten wurden die Berggebiete zu einer agrarischen Problemregion, in welcher die meisten Bergbauern auf außer-agrarische Nebeneinnahmen angewiesen sind. Da die Industrie und das Gewerbe wegen der ungünstigen Standortbedingungen kaum konkurrenzfähig sind, kommt vor allem der Tourismus als Nebenerwerb in Frage. Während im österreichischen Durchschnitt nur 12 Prozent der außeragrarischen Erwerbseinkommen auf den Fremdenverkehr entfallen, sind es im Produktionsgebiet "Hochalpen" 36 Prozent. Innerhalb der Zimmervermietung können zwei Typen unterschieden werden: In den meisten Regionen dominiert der Urlauberfremdenverkehr. Lediglich im Naherholungsraum der Großstädte - vor allem von Wien (Ostösterreich) und München (Westösterreich) - erzielen die Bauern auch aus der ganzjährigen Vermietung von Freizeitwohnungen an Städter erhebliche Einnahmen. Die Bedeutung der Zimmervermietung zeigt deutliche West-Ost-Unterschiede. Der Typ des "Fremdenverkehrsbauern" herrscht im westösterreichischen Almbauerngebiet vor. Sein Hauptverbreitungsgebiet hat sich in den letzten 20 Jahren nur unwesentlich gegen Osten vorgeschoben. Die Zukunftsaussichten für den "Urlaub auf dem Bauernhof" sind weniger günstig, als vielfach angenommen wird. Sie hängen in erster Linie von der touristischen Nachfrage ab, die sich - bedingt durch die Struktur des Angebotes und die allgemeinen Entwicklungstendenzen des Fremdenverkehrs - in den Wintersportzentren günstiger entwickeln wird als in den Gebieten mit vorherrschenden Sommerübernachtungen.

* * *

1. INTRODUCTION

As a result of the great importance of mountain farming - the so-called "mountain communes" share three quarters of Austria's total area, and the officially registered "mountain farms" cultivate two thirds of the total acreage of our state - many geographical studies have dealt with the structural change of mountain farming since the beginning of the industrial age (cf. LICHTENBERGER 1975, PEVETZ 1974, 1984). E. LICHTENBERGER (1965, 1979) summarized the studies which had partly used different approaches and has interpreted the developments in the mountain regions as a part of the process of adaptation of our society to the conditions of a modern industrial and service society. As a result she developed sophisticated space and time models. According to these, the present regional process of change within the Austrian mountain regions reflects the conflict of space requirements of a continually decreasing agrarian society on the one hand and an increasing modern leisure society on the other hand.

2. ESSENTIAL FEATURES OF THE PRESENT CHANGES IN MOUNTAIN FARMING

For a long time those mountain communities situated far away from industrial agglomerations were a region of persistence of the society's structure, in which traditional forms of life and economy have been able to survive. Older studies of ethnologists (cf. WOPFNER 1951-1960) as well as the results of the Innsbruck school of historical population geography, founded by H. KINZL (1959), substantiate these facts.

The time-lag in the change in society has assisted the persistence of the traditional agrarian system in the Austrian mountain regions typically orientated towards self-sufficiency. The partial abandonment of subsistence crops clearly reflects a shift to modern, capital-intensive and market-orientated agriculture, as proved by G. BLOHM (1977) in Germany (cf. *Table 1*).

Table 1 Percentage of subsistence crops in the gross yield of typical lowland and mountain farms in Austria 1948-1985

		Lowland farms*	Mountain farms**
1948	%	18,2	28,7
1958	%	6,8	22,9
1968	%	4,6	15,8
1981	%	2,3	12,5
1985	%	3,2	12,0

* 20-50 ha grain-growing farms in the North-Eastern lowlands

** 20-50 ha grassland-forest farms in the High Alpine regions

Source: 1948-1968: LÖHR 1971; 1981-1985: BUNDESMINISTERIUM 1982, 1986

The delay in the decrease of subsistence farming can be proved by means of the results published for the so-called "bookkeeping farms" in Austria. With mountain farms - a 20 to 50 ha grassland-forest farm in the high mountains - the share of self-sufficiency was almost three tenths just after the Second World War, at present it is only one eighth. On a typical lowland farm - a 20 to 50 ha grain-growing farm in the North-Eastern lowlands - the share was already considerably lower in 1948. At the moment self-supply does not play any part there.

The change in the economic goals of mountain farming was caused by the shortage of agricultural workers who had gradually moved to other jobs, a process which occurred in a similar way in the rest of Europe, too. Therefore the farmers were forced to reorganize their farms and to concentrate on one branch of farming to an increasing degree. Agrarian cultivation

has thus been significantly changed. Grassland predominates more and more, the stage depending on the development of the modernizing process as well as the ecological conditions (cf. *Table 2*).

Table 2 Relationship between fields and grassland in Austria's mountain regions in 1980

Province	Area of fields per 100 ha grassland (excluding Alpine pastures)			
	Non-mountain area ha	Mountain area zone 1 ha	Mountain area zone 2 ha	Mountain area zone 3 ha
Burgenland	97	64	53	--
Carinthia	115	68	44	34
Lower Austria	938	150	60	51
Upper Austria	178	64	42	35
Salzburg	18	18	14	15
Styria	128	43	41	27
Tyrol	48	49	29	25
Vorarlberg	15	2	1	0
Vienna	388	-	-	-
Austria	280	76	42	30

Source: ÖSTZ 1982-1983

The relationship between the areas occupied by fields and grassland impressively proves the increasing specialisation of mountain farming land use in fodder production: Whereas there were 280 ha of arable (including field parcels not in use) per 100 ha grassland (excluding Alpine pastures) in the non-mountainous regions according to the agrarian census in 1980 (ÖSTZ 1982-1983), the corresponding figure for mountain farms was considerably below 100 ha, whereby grassland dominated most in the extreme mountain regions (zone 3).

The statistical data for the provinces show a typical contrast between east and west. As mountain farming was modernized earlier in the western provinces, grain growing has decreased more strongly. The delay between phases of economic change has had consequences for the type of production in the cattle breeding dominant now. As a result of the early institution of cattle breeding in Western Austria, the sale of breeding cattle is in the foreground as well as the keeping of dairy

cattle; by contrast in the Eastern Austrian forest farming regions ("Waldbauerngebiet") the keeping of slaughter cattle, which is in some parts extensively done, plays a significant role.

The general structural change, especially the rural exodus, has favoured mechanization, which is more difficult in the mountains because of the gradient of the agricultural acreages. The change-over to specialized grassland farming has led to a new evaluation of the natural resources. Whereas before south-facing fields were considered favourable locations for agriculture because of the greater supply of warmth, now the priority has shiftet to low-lying locations, which can be cultivated more economically.

Table 3 Cost of wages and machines for the cultivation of sloping meadows in comparison to the use of a "normal" tractor (=100) in 1976

Type of machines	Gradient of slope in %	Costs of cultivation wages	machines	total
"Normal" tractor	0 - 20	100	100	100
Four-wheel drive tractor	20 - 40	121	147	142
Motorized cart	40 - 60	154	229	214
Machines controlled by hand	60 - 80	529	204	268
Work done purely by hand	80 - 100	1084	112	303

Source: SCHLECHTNER 1978

Even with the use of meadows, which is typical of the Alps, the costs increase according to the inclination of the slope (cf. *Table 3*). According to studies by G. SCHLECHTNER (1978) the total expenditure (costs of wages, machines etc.) amounted to AS 5.043,- per ha with a meadow mowed twice a year, with drying the grass on the ground and the use of manure in the regions farmed with a "normal" tractor in 1976. In the steep areas that can only be cultivated by hand the costs increased by up to three times as much. As the yields usually decrease with increasing inclination, the majority of fields next to such steep meadows, on which only machines controlled by hand can be employed (mower, hay-maker), have already become marginal yield lands. Nevertheless they are used by farmers for the most part, because the cost of wages is negligible, since the work is done by the farmers' families.

The differing costs of cultivation led to a remarkable concentration of agricultural land use as well as an increase

of grassland, which has made the Alpine landscape more monotonous. The loss of arable on the steep mountains has been compensated by intensification of flat areas. This resulted in changes to the typical stepped system ("Staffelsystem") with which the mountain farmers had integrated the upper altitudinal zones of the mountains into the agrarian land use (cf. *Figure 1*).

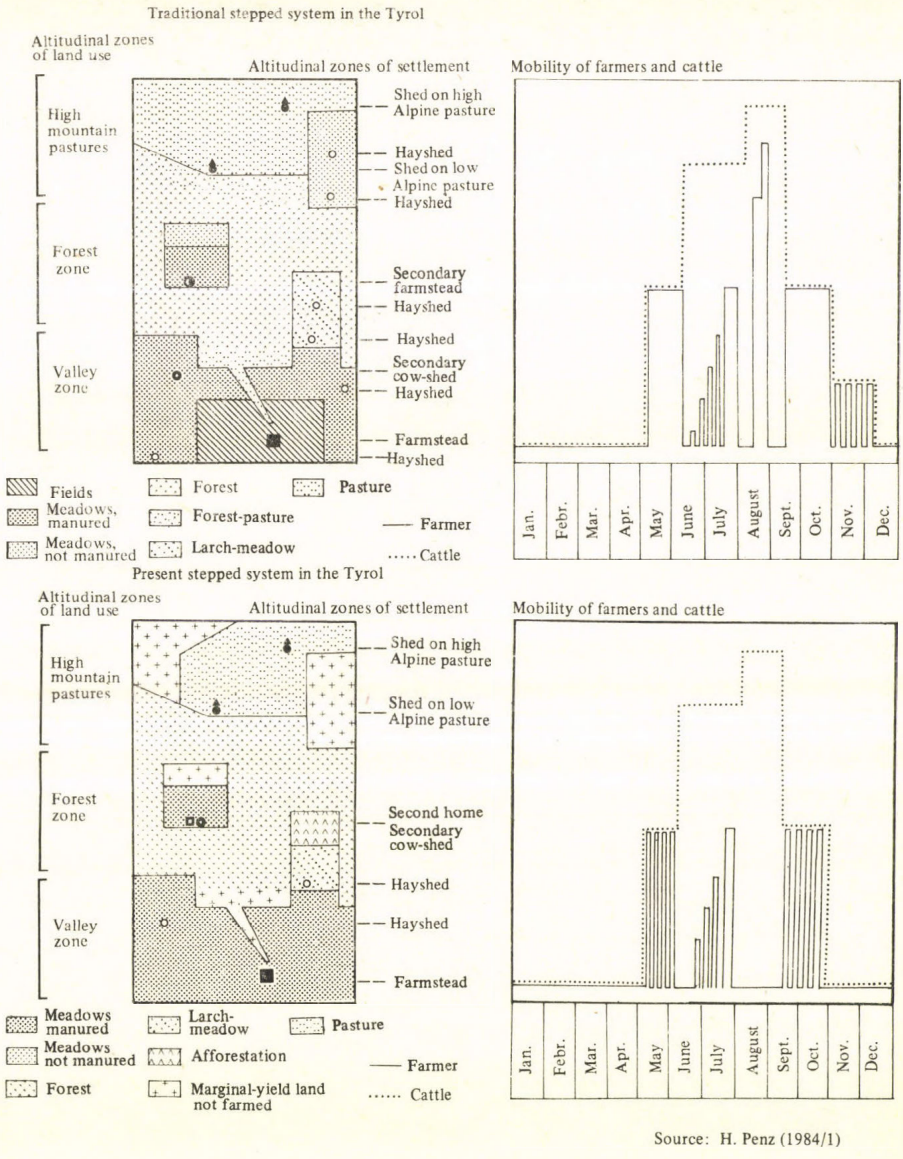
The traditional mountain farming stepped systems had solved the difficult problem of transportation by building various farm sheds in the different altitudinal zones, some of which, though habitable, are used only seasonally. Within the Austrian Alps the stepped sytems have developed differently. In the Western Austrian High Alps they are usually divided into three zones. The valley zone is followed by the forest zone which also includes manured meadows and sheds that are occupied during one season (secondary farmsteads) as well as sheds of low Alpine pastures and non-manured meadows; the highest zone of land use is the high Alpine pasture zone. The stepped system of the Eastern Austrian forest-farming regions is usually divided into two zones, with the forest zone and the Alpine pasture zone interlocking.

During the recent structural transition agrarian land use has concentrated on the valley zone. The agricultural lands of a community are opened up by paths. Thus many hay sheds lost their functions and became dilapidated. Especially the larch-meadows in the forest zone have been abandoned, whereas a lot of manured meadows near the former seasonally used mountain sheds were opened up by roads so that they can now be managed from the valley. On the High Alpine pastures the imminent decline of pasturing was stopped by strong government support in the last decade (subsidies for costs of Alpine pasturing and for investments) (cf. *Figure 2*, PENZ 1984/2).

3. TOURISM AS THE FARMER'S SECOND OCCUPATION

As the natural productivity becomes more unfavourable with increasing height and as the costs of cultivation grow according to the gradients of the slopes the mountain farming area has developed into an agrarian problem region in which the agrarian income decreases more and more in comparison with active agrarian regions of the lowlands. As a result of this development the mountain farmers have become a group of the society which struggles for its existence under most difficult conditions (cf. SCHIFF & BOCHSBICHLER 1977). Since society has recognized the achievements of the mountain farmers for the preservation of the Alpine environment, they are supported by the government with direct payments and other forms of mountain farms subsidies; but these funds provided by the government are by no means sufficient to compensate for the natural disadvantages of the locations.

If only viable full-time farms (Vollerwerbsbetriebe) are supported in the mountain farming region, it is to be feared



Source: H. Penz (1984/1)

Fig. 1 Stepped systems in the Tyrol

that a great number of farms will be closed down in the non-too-distant future. The consequences would be disastrous for the regions because many supply insitutions could lose their

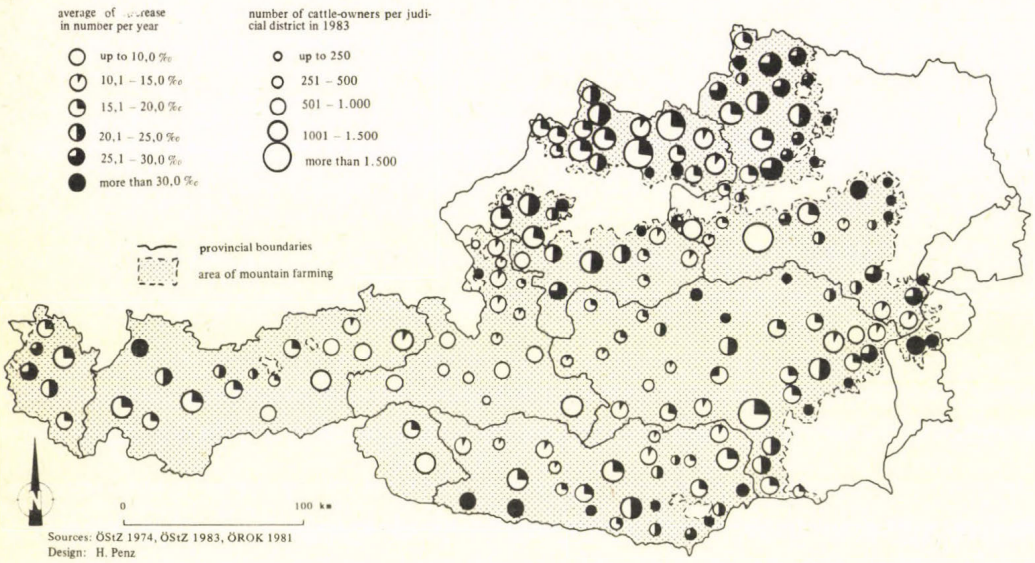


Fig. 2 Changes in the number of cattle-owners in the area of mountain farming in Austria 1974-1983
(units represented: judicial districts)

basis of existence. The Austrian government wants to prevent the depopulation of mountain communities and strives to keep them functioning. They, therefore, attach great importance to a second rural occupation.

In consequence of the location outside the active economic regions, the possibilities to take up a second occupation in another, non-agrarian field are very limited in many mountain farming communities. That is why the proportion of full-time farms is normally slightly higher in the different zones of the mountains than in the lowlands (non-mountain area). The variations between the different regions of Austria - as clearly shown in the quotas of the provinces (cf. *Table 4*) - are even more marked than the contrast between mountains and lowlands.

Table 4 Proportion of full-time-farm in the total number of farms by province in mountain zones in 1980

Province	Proportion of full-time farms in the total number of farms				
	Non mountain area %	Mountain area zone 1 %	Mountain area zone 2 %	Mountain area zone 3 %	Total %
Burgenland	26,3	20,7	16,0	-	25,9
Carinthia	24,0	36,7	38,9	48,5	33,4
Lower Austria	42,6	50,8	51,5	49,1	45,2
Upper Austria	38,3	39,7	36,8	37,0	38,3
Salzburg	42,2	44,4	45,6	42,9	43,4
Styria 34,5	34,5	46,0	46,6	47,7	38,4
Tyrol	28,6	38,5	34,0	36,1	34,3
Vorarlberg	19,7	49,3	43,5	32,7	31,3
Vienna	52,6	-	-	-	52,6
Austria	35,3	44,0	42,2	43,1	38,3

Source: ÖSTZ 1982-1983

Because of the unfavourable conditions local trade and industry usually do not play a significant role in mountain farming communities. Commuting also poses a problem because of the great distances to the industrial and trade centres. Tourism gains importance as it is favoured by the advantageous potential of the mountains for leisure activities. The income from tourism forms a very important part of the overall receipts for mountain farms. This fact is documented in *Table 5* which presents the pertinent data for the "bookkeeping farms".

A considerable part of the income from a second occupation in tourism results from the letting of rooms, which has developed differently in the various leisure regions (cf. *Table 6*). In those communities in which "holiday tourism" dominates, private rental of rooms is in the foreground. It is propagated and supported by the agricultural boards (Landwirtschaftskammern) and also by the campaign "holiday on the farm" ("Urlaub auf dem Bauernhof"). In the leisure regions near the big cities, however, the rental of second homes plays a considerable part. This is especially true for the mountain farming communities to the South and Southwest of Vienna; e.g. in the commune Aspangberg-St.Peter in the Wechsel region 63 rooms were let by a total number of 191 farms to Vienna residents in 1980 (ÖSTZ

Table 5 Structures of non-agrarian incomes per farm in the main regions of agrarian production 1985

Main region of agrarian production	Salaries, wages, old-age and other pensions %	Incomes from tourism %	Other incomes %
NE-Lowlands and hilly country	93,6	4,7	1,7
SE-lowlands and hilly country	90,0	2,5	7,5
Foreland of the Alps	82,4	0,6	17,0
Basin of Carinthia	52,7	7,5	39,8
Bohemo-Moravian Granite Massif	85,4	2,4	12,2
Eastern borderland of the Alps	78,2	8,9	12,9
Lower Alps	75,5	14,8	9,7
High Alps	57,4	36,3	6,3
Austria (total)	78,8	11,8	9,4

Source: Bundesministerium 1986

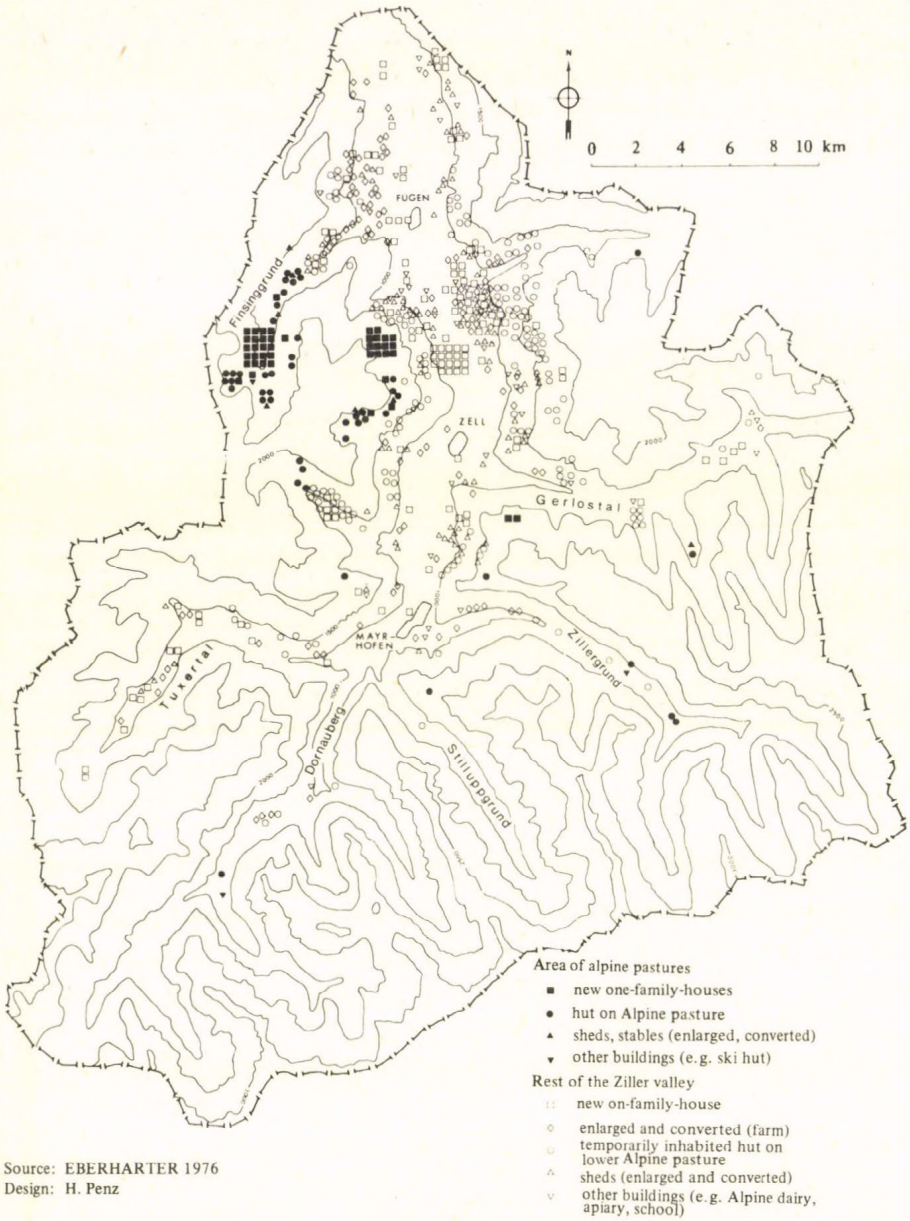
1982-1983). In Western Austria second homes are chiefly let to people living in the Munich agglomeration. Regarding this the Zillertal (Tyrol) is characteristic, because only 30 percent of the second homes were used by Austrians, but more than 50 percent by people from Munich in 1975. Apart from second homes and apartments in private houses many buildings that were formerly used agriculturally served as second homes in the valley zone as well as in the forest and Alpine pasture zones (EBERHARTER 1975) (cf. *Fig. 3*).

The regional significance of letting rooms in mountain farm houses can be assessed from the results of the agricultural census in 1980 (ÖSTZ 1982-1983). According to them the type of "tourism-farmer" ("Fremdenverkehrsbauer"; LICHTENBERGER 1967) predominates especially in the Western Austrian Alpine pasture farming region ("Almbauerngebiet"). During the last two decades this form of life that can be described as "standing on two economic legs", has only slightly expanded to the cast. It now include the upper Styrian Mur valley and the Styrian Enns valley (= Upper Styrian peripheral regions), where every fourth farm let rooms in 1980. In the Austrian forest farming

Table 6 Proportion of farms with rental of rooms in the total number of farms in the Austrian mountain communes in 1980

Region	Of the total number of farms ... per cent offered rooms for rental Types of communes according to the zones of difficulty of cultivation						
	Little	Little medium	Medium -great	Great	Extreme	Most extreme	Total
	%	%	%	%	%	%	%
Vorarlberg	8,5	13,1	22,7	38,2	45,2	46,2	22,7
Western Nor North Tyrol	28,7	20,9	42,8	33,5	48,7	24,8	36,5
Western "Almbauerngebiet"	21,2	14,8	33,5	36,6	47,9	29,7	29,9
Eastern North Tyrol	28,5	42,6	42,5	39,2	40,8	30,8	38,3
East Tyrol	35,2	22,4	25,1	22,3	49,3	22,2	28,7
Salzburg	22,5	35,1	39,3	36,9	31,3	40,7	33,6
Upper-Carinthia	30,9	30,8	26,5	33,8	11,9	44,4	29,8
Eastern "Almbauerngebiet"	27,0	36,6	28,9	35,2	37,5	32,6	33,8
"Almbauerngebiet"	25,4	29,7	35,1	35,4	43,3	31,1	32,6
Upper Austrian Alps	7,1	16,8	17,2	8,7	6,9	-	11,6
Western Lower Austrian Alps	3,0	7,9	9,0	12,3	10,4	-	7,1
Eastern Lower AustrianAlps	5,4	7,5	8,3	15,7	28,8	-	9,9
Burgenland	3,0	2,4	3,7	-	-	-	2,9
Middle and East Carinthia	16,3	14,0	10,8	9,0	18,8	-	13,4
Peripheral regions Upper Styria	22,3	20,0	30,7	30,8	26,5	20,9	26,9
Industrial regions Upper Styria	8,2	10,7	10,3	14,2	10,4	-	10,9
Borderland of Styrian Alps	3,7	7,1	7,7	10,9	12,7	-	7,6
"Waldbauerngebiet"	8,6	12,6	12,4	13,2	15,1	20,9	11,4
Austrian Alps	13,0	19,7	19,5	21,1	32,8	30,8	18,9

Source: ÖSTZ 1982-1983



Source: EBERHARTER 1976
Design: H. Penz

Fig. 3 The second homes in the Ziller valley

region ("Waldbauerngebiet") "holidays on the farm" ("Urlaub auf dem Bauernhof"), however, only plays a role in the few more tourism-orientated areas.

Within the various parts of the Austrian Alps the differences in letting rooms correspond to the respective stage of the touristic development. Agrarian factors fade in importance. This is especially true for the factor of difficulties in cultivation on mountain farms which hardly influences the generally existing willingness to let rooms. The slightly higher percentages in communities with great to extreme difficulties can exclusively be ascribed to tourism-oriented factors. The readiness of mountain farmers to take up a second occupation in tourism depends among other things on the structure of the farms. In the Austrian Alps small and medium-sized farms dominate even in those regions which are noted for outstanding farm sizes (Eastern North-Tyrol, Salzburg). The small and medium-sized farms can only gain an up-to-date overall income by means of a second occupation. The farmers are very interested in earnings from tourism because it can be combined well with agriculture - as W. PEVETZ (1983), among others, showed.

4. FUTURE PROSPECTS OF "HOLIDAYS ON THE FARM"

An increase in "rural tourism" would be desirable for all those farms which have not participated in tourism up to now. The prospects for the future seem to be less favourable, though, then the responsible authorities in the Federal Government, provinces and agricultural boards (Landwirtschaftskammern) presume (cf. PEVETZ 1983). These authorities try hard to expand the renting of rooms on the farms and are striving to support it by specific advertising ("holidays on the farm" etc.) among other methods. It is questionable, however, whether it will be possible even to retain the present position. The future of the rural rental of rooms depends far less on the willingness of the farmers than on the general tendencies in tourism. Accordingly the prospects can best be judged in winter tourism because it is to be expected that skiing holidays will hold their position in future. The prospects for mountain farming agriculture are also favourable in those winter resorts that do not yet show strong tendencies towards urbanisation. The seasonal variations in the work load should be advantageous for their survival. In winter there is least work to do on the farm, and during the peak of work in summer tourism plays only a secondary part. That is why mountain farming has been able to survive extremly well in some Western Austrian winter sport regions (e.g. West Tyrol, Kitzbühler Alpen) (cf.*Figure 4).*

Outside the winter sport regions and in the lower-lying areas only summer tourism has been able to develop. Its prospects are unfavourable. These resorts wich are visited mainly by a few wealthy groups of guests usually offer very few facilities for leisure activities. Rooms in lower price classes predominate, and particularly in farmhouses only simply equipped rooms are offered. In spite of the extremely low prices it

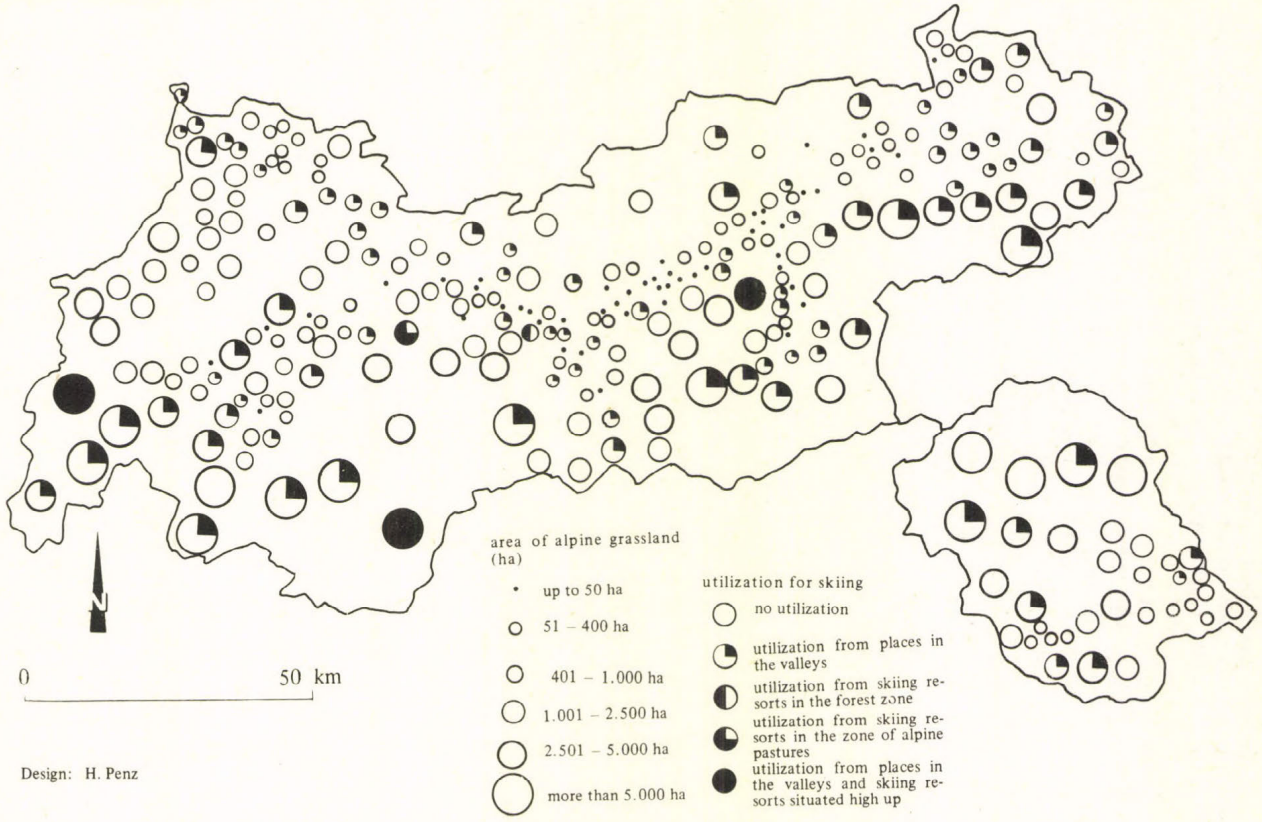


Fig. 4 The utilization of High-Alpine pastures in the Tyrol skiing

will become more and more difficult to attract tourists in future because of the lack in quality. Moreover the readiness to let rooms will decrease. The farmers will consider the load work unreasonably large for the low income. Moreover the main season of tourism coincides with the absolute peak of agricultural work in summer.

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THE PHENOMENON OF SECOND HOMES WITHIN THE FRAMEWORK OF THE HOUSING MARKETS: THE VIENNA EXAMPLE

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SUMMARY

In international research into second homes the changes within the societal and economic framework are considered the most important determinants for a boom of second homes.

When studying the phenomenon of second homes in an intercultural perspective, the following statements can be made:

(1) It is a typical feature of modern industrialized countries, independent of the political and economic systems.

(2) It is a phenomenon bound up with large cities mainly, and it is due to their existence that there are so many second homes.

(3) The relative importance of second homes is not correlated to the socio-economic and administrative structure of the individual countries, but depends mainly on the structure of the housing markets and housing politics.

The goal of this paper is a twofold one, namely

(1) to describe the importance of housing politics (liberal versus social housing politics) for that of second homes and

(2) to present the effects of social housing politics on the phenomenon of second homes with respect to the Vienna example, and to show its interaction with the urban system.

ZUSAMMENFASSUNG

In der internationalen Zweitwohnungsforschung werden die geänderten gesellschaftlichen und wirtschaftlichen Rahmenbedingungen als wichtigste Push-Determinanten im Zweitwohnungsphänomen genannt.

In einem interkulturellen Vergleich des Zweitwohnungsphänomens gelten folgende generelle Aussagen:

(1) Es ist eine typische Erscheinungsform moderner Industriestaaten, unabhängig von politischen und wirtschaftlichen Systemen.

(2) Es ist vor allem ein großstädtisches Phänomen und erhält von diesem die Massenhaftigkeit.

(3) Die Zweitwohnungsintensität korreliert nicht mit dem sozio-ökonomischen Entwicklungsstand, sondern hängt sehr wesentlich von politisch-ökonomischen und administrativen Strukturen der einzelnen Länder und hier vor allem von der Wohnungswirtschaft und Wohnungspolitik ab.

Der Beitrag verfolgt zwei Zielsetzungen:

(1) generell die Bedeutung der Wohnungspolitik (liberale versus soziale Wohnungspolitik) für die Zweitwohnungsintensität darzustellen und

(2) am Beispiel Wiens thesenhaft die Folgen einer sozialen Wohnungspolitik im Hinblick auf das Zweitwohnungswesen bzw. die Wechselwirkungen auf das städtische System aufzuzeigen.

* * *

1. INTRODUCTION AND DESCRIPTION OF THE PROBLEMS

In the extensive pertinent literature on second homes normally changes in the economic and social framework are given as the most important push-factors for the boom of this phenomenon:

- A growth in the spending power, and even a surplus of it, and economic prosperity, especially of the middle classes, brought about a growing standard of living and, consequently, higher claims as to individual styles of life and quality of life. A one-family-house with a private garden always had been wished for by city-dwellers latently (because of their "roots" being in rural areas, or an attempt at imitating the style of life of the wealthy). To make this dream come true is within reach of a growing number of them.

- Shorter daily and weekly working hours and, thus, longer coherent periods of leisure were a prerequisite for a fundamental change in the leisure and recreation behaviour. Leisure was reevaluated and gained a higher degree of prestige ("change in the scale of values"), leading to a dichotomy of the housing function (LICHTENBERGER 1980:3), a "parcelling of life" (ROMEIß 1980) and a spatial separation of housing for work and for leisure. Leisure is gaining in importance, thus leisure behaviour increasingly becomes typical for a post-industrial, mobile society.

- Freedom of action with respect to changes of location has been considerably increased by the process of motorization of the city-dwellers. The enormous growth of passenger-car traffic in the inner cities as well as stress brought about by noise, air pollution through exhaust fumes and dust were additional motives for leaving the city areas at least temporarily.

When comparing the phenomenon of second homes in an intercultural perspective the following statements can be made:

- Second homes are a mass phenomenon of our times in all industrialized countries.
- Especially the existence of large and million cities caused this boom.
- The phenomenon is independent of political and economic systems
- It does not necessarily coincide with a high standard in the socio-economic development, but depends, to a large degree, on the economic and administrative structures of the individual states, especially the conditions in the housing market and the housing politics. This paper, essentially, focusses on describing these relationships.

2. THE INFLUENCES OF POLITICAL AND ADMINISTRATIVE STRUCTURES ON THE PHENOMENON OF SECOND HOMES

In the extensive literature on second homes referred to above hardly any mention is made of the importance of the influences of political and administrative structures, though the varying degrees of development cannot possibly be explained fully by "social changes" or the standards of living attained. In an inter-cultural comparison, one is confronted with the fact that second homes are of little importance in the United States of America or in the Federal Republic of Germany, but very numerous in Socialist countries (e.g. in the surroundings of Prague and Budapest) in spite of the low living standards there, thus proving that neither political nor economic systems determine this phenomenon. An attempt at explaining the large number of second homes in the Eastern Bloc by stating that they are the only way for compensating the consumers' demand for goods that are not available is not satisfactory.

LICHTENBERGER was among the first scholars to point out that "both the structure and the future development of second homes can only be explained and prognosticated when considering the existing urban physical structures, the housing market and the housing politics that determine the behaviour of the population and its attitude towards second homes" (LICHTENBERGER 1980:3).

Table 1 The influence of housing politics on the phenomenon of second homes (simplified presentation)

"LIBERAL" housing market (capitalistic housing market)	"RESTRICTIVE" housing market (social housing market)
- free market economy (private capitalism)	- private capitalism practically eliminated (state intervention)
- (economic) restrictions within the market for the consumer	- restrictions "decreed from above" for the developer
- restrictions as to specific sectors of the housing market (especially for lower and middle classes)	- advantages of social housing (rent limitations, tenants' protection, housing allowances
- high costs of housing (rents not restricted)	- low costs of housing
- freedom of action as to locational choice limited	- freedom of action as to locational choice (surplus spending power)
- splitting-up of residence function impossible	- splitting-up of residence function feasible (main residence and second home)
- satisfizer behaviour with respect to housing: change of residence within the city or to suburb or investments into apartment	- satisfizer behaviour with respect to housing: "supplementation" by means of second home
- high degree of suburbanization	- low degree of suburbanization
- comparatively few second homes	- great number of second homes

Accordingly (cf. *Table 1*)

- blocks of flats combined with restrictions in the housing market on the part of the authorities (tenants' protection, therefore reasonable rents) contribute towards a boom of second homes (e.g. in the Vienna area in Austria, in the Socialist countries, in France and Sweden). Normally there is no need to relinquish the flat in town, in many cases (see below) there is, however, a passing-on of the habitat to a younger generation planned for a later date.
- A large proportion of one-family-houses within large cities as well as a capitalistic housing market check the number of second homes (e.g. in the Federal Republic of Germany and in Great Britain) due to high housing costs. If the quality of life seems to be impaired with respect to the apartment or its surroundings the measure taken often is moving to the suburbs. The flat in town is being relinquished.

When comparing the extent of the second homes' phenomenon around some large cities in Europe (cf. *Table 2*) a few general statements can be presented, though the effects of both different definitions of "second homes" and varying data collection periods must be borne in mind:

- There are comparatively few second homes in countries with liberal housing politics, where there is a large extent of suburbanisation of the population.

Table 2 The phenomenon of second homes with respect to a sample of large European cities

LARGE CITIES	HOUSING POLICY	
	LIBERAL	SOCIAL
	households(%)	households (%)
Hamburg[1] (1970)	7,0 (users)	
Munich[1] (1968)	7,3 (users)	
London[2] (1973)	2,0 (owners)	
Paris[3] (1973)		ca. 20,0 (owners)
Stockholm[2] (1970)		ca. 22,0 (owners)
Vienna[4] (1973)		ca. 19,0 (owners)
Vienna[5] (1984)		ca. 23,0 (owners)
Prague[2] (1973)		135.000 units

sources: [1] Ruppert 1973, [2] Coppock 1977, [3] Clout 1974, [4] ÖIR 1975, [5] Baumhackl (own survey)

- Countries with restrictive housing politics (and social housing), on the other hand, have a large ratio of second homes and comparatively little suburbanisation of the population.

In this context it is important to note that there are different scales of values applied in connection with evaluating the second homes on the part of their owners:
- with regard to their function (leisure habitat or "potential main habitat"),
- concerning the motives for the erection or purchase,
- with respect to the physical structure, size and equipment
- and the frequency of using them.

To a large extent they depend on the quality attached to the urban habitat and its surroundings, thus either a tendency towards a dichotomy of habitats for work and leisure or the desire for a high standard of housing as such are in the foreground.

Surprisingly enough a large proportion of the owners of second homes declare to be quite satisfied with their urban habitat (cf. e.g. the empirical studies published by LICHTENBERGER 1980, VACHA 1979). VIELHABER (1983:259) holds that this result is the outcome of a lacking differentiation of the possible types of second homes (see also the "dilemma" of the Austrian 1981 census).

3. SECOND HOMES IN AUSTRIA

3.1. Sources and data

In Austria, the Central Office of Statistics collected data on second homes within the framework of the general censuses (population census and census of houses and apartments) both in 1971 and 1981. Moreover there were micro-census studies made in 1971, 1976, 1978 and 1979. Unfortunately there is very little scope for a comparison of these data because of different definitions, data collection methods and basic theoretical concepts. As no functional criteria have been introduced yet for defining second homes this term still is diffuse in meaning. For this reason the phenomenon could not be described concisely both in qualitative and quantitative terms so far.

One dilemma as to a definition arises from the fact that, in the case of a population census on the one hand, the focus is on the users of second homes, whereas with a census of houses and apartments the stock of houses is in the centre of interest. Because only "apartments proper" that were, moreover, being used regularly were being counted as second homes, all forms of mobile and make-shift housing were excluded. On the other hand, sometimes the "users" and at other times the "owners" of second homes were registered.

The "users" comprise people who are allowed to make use of someone else's (a relative's of friend's) second home regularly (BAUMHACKL et al. 1985:37).

3.2. Development and present numbers

Summer residences of the nobility and members of the bourgeoisie as a sort of "elegant second homes" have been existing around Vienna ever since the Baroque period. It was LICHTENBERGER (1980 :9) who described the historical types of second homes in the Vienna region (cf. EGGERT et al. 1982), pointing out there were characteristic "successive eras" in connection with the city's growth and expansion into the area of former suburbs and with the changes in the locational evaluation for summer palaces, country houses and villas with respect to aesthetic principles applied to nature, locational advantages and distance from the city.

During the Founders' Period railways were built, thus allowing for locations further away from the city. Of course the development of the second homes' periphery occurred in a linear way, along the Southern Railway near the Alpine fringe (Semmering) and around the Carinthian lakes, along the Western Railway in the Vienna Woods and the area of the Salzkammergut lakes (Bad Ischl), and along the Northern Railway in the Kamp valley.

This elegant periphery of second homes fell victim to the downfall of the Austro-Hungarian Monarchy after World War I. Due to the pauperization of the nobility many of the summer villas were being taken-over by the indigenous population.

During the interwar period a wide zone of allotment gardens was formed at the fringe of the densely inhabited areas, mostly within walking distance from the large blocks of flats, partly organized by a "settlers' movement" and based on the desire for, and need of, a self-supply with fruit, vegetables and small livestock. They constituted the very first beginnings of summer and weekend settlements, but often had to serve as shelters, too. Only members of the upper class were able to afford summer residences proper in the traditional locations.

Just after World War II the tendencies in the second homes' sector were similar to those in the Founders' Period, on a smaller scale though. Only during the sixties second homes became a mass phenomenon due to the inclusion of the middle classes. Both the type of "leisure habitat" and of "potential main habitat" developed rapidly (see also BERNT 1964). This boom was strongly influenced by sociocultural connections with rural areas (cf. areas of rural exodus like Burgenland, Weinviertel, Waldviertel), but also by the chance to visit with relatives as well as by changes in the societal framework (see above). There were developments mainly in the (daily) commuters' area of the Vienna city region in the west, south and east, locally also in the Waldviertel and in Burgenland. A similar growth, on a smaller scale though, was to be observed around the provinces' capitals.

Early in the seventies an increasing spatial expansion started (cf. HAIMAYER 1979, BAUMHACKL et al. 1985:38). Two trends were to be observed:

- Leisure habitats came into existence in a more distant periphery and even in less attractive surroundings. Only members of the upper class and those with high incomes could still afford to buy lots within the city boundaries. This resulted in marked segregation tendencies in attractive areas near the

central cities, but also in a superposition of the indigenous population by migrants and owners of second homes. The climax of the second homes' boom in Austria occurred in the mid-seventies. All communes were in danger of being included, especially next to the urban fringe, into the area of second homes as soon as there were building lots for sale or if permission was given for "cheap variants", such as allotment gardens or shelters only habitable part of the year, the second homes for "the man in the street".
- On the other hand there was a boom of condominium-style apartment-houses for holiday-use in resorts especially in the Tyrol, Carinthia and Salzburg that were widely discussed in the media as a "sale of the landscape" to foreigners. Acts by the various provincial governments put a stop to this development at the end of the seventies (cf. ASSEM 1981).

Since then, as an effect of the economic recession, the development of second homes has slowed down. It is to be expected that there will be an increase in suburbanisation especially due to the type of "potential main habitat". The market for second homes has become slack mainly at larger distances with a predominance of visits at the weekend only. Moreover it is to be feared that there will be an exodus from the central cities, with the apartments there being relinquished and, consequently, resulting in further economic disadvantages for the central city in periods of economic crises.

4. THE VIENNA SECOND HOMES' REGION

4.1. General description

The Vienna second homes' region comprises the following provinces or parts of provinces mainly: the outskirts of Vienna, Lower Austria, Northern and Central Burgenland and Eastern Styria.
When it is postulated that the location and the number of second homes (both the leisure habitats and the potential main habitats) depend on three factors, namely
- the attractiveness of the natural surroundings,
- the accessibility and
- the price of real estate

(with the first one considered a constant and the other two determining the demand[1]), Vienna, somehow, has the position of a solitary city (cf. ROBERT 1974, SCHNELL 1977:180) comparable to the central city in von Thünen's land use model (LICHTENBERGER 1980:6).

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[1] Locations near the city are most in demand (central-peripheral diffusion of the phenomenon of second homes). At the same time there is an increasing competition with other forms of landuse nearer the central city. The cost of real estate decreases with the distance from the city centre (price gradient), but is also determined by locational qualities (attractiveness, accessibility, demand).

Fig. 1 Second and further homes in communes within and outside the Vienna urban region

A basic hypothesis could be formulated in this way: For the groups with high incomes distance from the city as measured by travelling time seems of utmost importance, therefore they prefer locations near the central city. Generally speaking, one could assume a ringlike structure with a centripetal social gradient, as actually proved empirically for Paris and Copenhagen. Things are, however, just the other way round in the Munich region (RUPPERT 1973), because attractive areas are lacking in the city's vicinity.

The main part of the Vienna second homes' region does not compete with those of other large cities (Graz, Linz) and there is hardly any influence by smaller towns. Thus, Vienna can actually be considered a model case, though there are a few interfering factors, namely sectorial differences in the natural attractiveness, persistence effects in some areas, natural barriers (Danube, Alpine Foreland), unequal accessibility and competing land uses (cf. *Fig. 1*).

4.2. The unique features of the Vienna situation

Other differences concerning the phenomenon of second homes between Vienna and other large cities (LICHTENBERGER 1980:6) can be described in the following way:

- There are unique conditions in the housing market. The sector of newly erected housing is dominated by the City of Vienna. With the older housing stock the Tenants' Protection Act is in force, thus rents are low, but there are high (mostly illegal) composition payments[1]
- Because of the comparatively low costs of housing, for many households extra financial means were available that were only invested in the apartments to a small extent, to a much larger one in an alternative habitat. The "first one-family-house as a second home" (LICHTENBERGER 1980:7), therefore, often is more comfortably equipped than the rented apartment in town that is considered quasi a piece of property because of the practically irrevocable tenancy agreements. Because of the low rents, there is no need to relinquish the appartment. In this way, the state finances, indirectly of course, the building of one-family-houses outside the city areas by subsidizing the future owner of a second home (and perhaps migrant) by means of the effects of the Tenants' Protection Act, by subsidies for building (see 1981 census), by housing allowances etc.

It can be assumed that the high ratio of second homes in Vienna, compared with that in the rest of Europe, is, to a large extent, affected by the almost complete elimination of private capitalism in the housing market. As many second homes are being turned into main residences later on ("stepwise exodus") without relinquishing the appartment in town in most cases,

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1 The Rent Act of 1982 did, however, introduce higher rents for the tenants of flats in the older building stock, too, due to the "stepped maintenance contributions", but is not being executed by many house-owners so far. Therefore, there still are extensive similarities with the situation in many countries of the Eastern Bloc.

"urban exodus" is the almost logical consequence - and it is accelerated by the deterioration of living conditions in the large cities.
- As opposed to the situation in the Federal Republic of Germany, most of the second homes resulted from personal, often spontanous, locational decisions and building activities. Therefore there is a wide spectrum of building types, building materials etc. Often it is impossible to distinguish between leisure habitats and residences proper. The result is an uncontrolled spread of settlements and spoliation of the countryside. Only a very few second homes were built and sold by developers. Such projects were mainly connected with the redevelopment of gravel pits or can be found locally, e.g. on the shores of Lake Neusiedl, and consist in rather make-shift types (mobile homes, allotment gardens, lake dwellings etc.). As opposed to the tourism areas in western Austria, condominium-type apartment houses play no part in the Vienna second homes' region.
- The building or purchase of a second home normally is not bound up with speculations on possible profits (economic rationality), but is based on satisfizer behaviour. Commercial use (i.e. letting with the aim of a better exploitation outside the periods of personal use) is being considered in a very few cases only. Things are quite different in the tourism areas and in other countries (e.g. Switzerland). On the other hand relatives and friends are often allowed to use these second homes for certain periods.
- There is a strong bond of many Vienna owners of second homes with the communes they came from originally. They might fulfil the function of preservers of the landscape, especially in areas with marked out-migration, as they tend to conserve the original physical structure of the farm houses. In the long run they constitute a stabilizing factor and no competitive force, a positive impulse assisting the recovery of "ailing" villages: At a later age these people often opt for returning to the native village.

5. THE INFLUENCE OF HOUSING POLITICS ON THE PHENOMENON OF SECOND HOMES IN THE VIENNA CASE

Below an attempt is made to give an outline of the unique situation of the Vienna housing market for the development of the phenomenon of second homes of the Viennese by means of a few hypotheses: [1]

[1] The statements given represent generalized findings of an extensive research project on the second homes of the Viennese. For the very first time an attempt has been made to study the phenomenon of second homes from the point of view of the main habitat in the city. Thus, households without second homes were included into the study as well. The project is being subsidized by the "Fonds zur Förderung der wissenschaftlichen Forschung in Österreich".

Hypothesis 1: *Restrictive (social) housing politics further the second homes' phenomenon.*

Restrictive housing politics bring about an almost complete elimination of a free market economy in the housing market sectors of interest for the lower and middle classes. They entail comparatively little housing costs for the main residence and, thus, largely, a free hand in locational decisions.

Table 3 shows the following facts:

1) The lower the overall housing costs (as a percentage of the net household income) the larger the participation in the second homes market. There are variations with the different housing markets, the social position of the households (larger net household incomes) etc.

2) The sectors of the housing markets of the main residences and of the second homes often are complementary (apartment - one-family-house etc.).

3) 64% of the owners of second homes live in council- or state-owned blocks of flats, cooperative housing or rented flats in blocks built before 1960.

4) about 70% of the owners of allotment gardens live in cooperative housing or in rented flats in houses built before 1960.

Hypothesis 2: *House-building subsidies are available for the second homes market as well and act as a stimulus for the second homes phenomenon*

About 20% of the owners of apartments as second homes and the same proportion of those owning a house as a second home (source: author's survey 1984) declared that they had received financial means in the form of house-building subsidies (number of unknown cases??). This use of funds for purposes other than originally intended of course robs many of those of their chance whose primary need for housing is not satisfied yet. This problem was widely discussed in connection with the 1981 census (BAUMHACKL et al 1985:39). "Family splitting" between the two habitats for financial reasons, problems of a "just" redistribution of revenue, Vienna's loss of population were the issues debated that even resulted in a contestation of the census on the part of the Vienna city government.

The conclusion to be deduced from these two hypotheses might be formulated in the following way: An indirect housing allowance in connection with the main residence, consisting in low housing costs, especially in social housing and in traditional tenement structures, and subsidies for house-building in the second homes housing market both for apartments and one-family-houses constitute a sort of subsidy for the second homes' phenomenon that might serve as an explanation for its rapid development in the Vienna case.

Hypothesis 3: *Low housing costs at the main residence enable people to retain the apartment in town even when actually having moved to the "second home".*

Many Vienna households tend, normally at a later stage in the life cycle, namely as old-age pensioners, to move to their former second homes, but to retain the apartments in town as a second

Table 3 Sectors of the housing market concerning the main residence and the second home, and housing costs

SECTORS OF THE HOUSING MARKET (MAIN) RESIDENCE	AVERAGE HOUSING COSTS % OF HOUSEHOLD INCOME		SECTOR OF THE HOUSING MARKET (SECOND HOME)[1]			Total
	1	2	one-family-house	apartment	hut in allotment garden	
social housing(council and state)	11,8	21,5	62,1 (18,4)	7,1 (12,3)	30,7 (30,5)	20,1
cooperative housing	11,3	21,0	58,6 (10,8)	16,1 (17,3)	25,3 (15,6)	12,5
rented apartment in traditional tenement house	12,7	20,6	72,5 (33,4)	11,9 (32,1)	15,6 (24,1)	31,4
apartment in condominium	9,4	16,6	71,3 (23,7)	12,7 (24,7)	15,9 (17,7)	22,6
owned apartment in traditional tenement house	12,3	19,7	65,4 (3,6)	23,1 (7,4)	11,5 (2,1)	3,7
one-family-house	22,5	28,6	68,4 (2,7)	21,1 (4,1)	10,5 (1,4)	2,7
			(100*)	(100*)	(100*)	100

1 = rent + operating cosots
2 = total housing costs

1) owners
*) sum does not equal 100% because official residences and flats provided by firms are not included

source: own survey 1984

home or in store for their children or grandchildren (ca 40% of all households with second homes), thus helping them to avoid the problem usually confronting newcomers in the housing markets. LICHTENBERGER (1980:4) reflected on this exchange of main residence and second home in the course of the life cycle.

It must, however, be borne in mind that, in many cases, economic problems are the motor for relinquishing the apartment in town sooner or later after all, once only one habitat can be afforded.

Hypothesis 4: *Restrictive housing politics bring about low mobility in the housing markets.*

About 76% of the owners of one-family-houses as second homes, the same proportion of owners of such apartments and 70% of those possessing allotment gardens with huts did not change their main residence during the past decade, whereas the corresponding proportion among those having no second home (many of them being fairly immobile because of old age!) amounted to 58%!

About 70% of the households with second homes have acquired those before 1970 already, almost 50% even before 1965.

It could be deduced from these statements that a satisfizer behaviour with respect to housing standards as to the main residence is being relinquished once these standards are met in the second home. Thus the low cost apartments in town need not be given up. Therefore, it is not surprising that about 42% of the owner of one-family-houses as second homes, about 36% of those owning an apartment and even 13% of the owners of huts in allotment gardens consider their present second homes their future main residence. About 32% of the owners asserted that, for this reason, they had invested more into their second homes, and another 16% had invested the same amount as into the main residence. A further detail stressing this tendency rests in the fact that the floorspace of second homes often (28%) surpasses that of the main residences.

Hypothesis 5: *"Back to the roots" - returning migrants or "homecomers".*

A majority of the present city-dwellers still have some connections with the rural areas they originally came from, through relations, possessions etc. Life in town might only be planned for a certain period, and one might expect to return eventually. This might be true for those about 30% of second homes' households that have their "roots" in the country. A similar number have inherited houses or plots. At a later stage the development in these cases will resemble that described with hypothesis 3.

"Scenario":

A very serious problem ought to be considered by the Vienna city authorities: What will the reaction of those owning second homes be like when the housing costs for the main residence are raised? When real wages decrease? In the survey, 14% assert-

ed that they would relinquish the main residence, another 9% would, however, give up the second home.

Each change in the present housing politics, for instance measures increasing the rents, would cause serious problems for Vienna

- by increasing suburbanization, as the one-family-house is preferred to the formerly low-cost apartment in town that did not meet the basic requirements - one habitat is relinquished,
- by an increase in the extent of blight phenomena in the central city, especially in low quality residential areas,
- by a decrease in Vienna's share in the revenue distributed among the communes according to their number of inhabitants and in the number of members returned to parliament,
- by a loss of investment.

Some of these trends were already manifest at the time of the 1981 census, but the process will only become fully effective with the 1991 census.

These vital problems ought to be solved in the near future. As things stand, Vienna's only choice is to try and perpetuate the present housing politics, thus preventing a further decrease of population through migration.

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NON-AGRARIAN ACTIVITIES OF LARGE AGRARIAN ESTATES IN HUNGARY

by

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SUMMARY

After reorganizing the ownership-system of Hungarian agriculture in 1960-1962, state farms, cooperatives and so-called special cooperatives were formed (the latter ones in areas of wine-growing, retaining an individual land-ownership) covering 90% of the country's arable land.

The big estates gained a higher degree of independence in organizing the structure of production than they had had formerly, and got an opportunity to cooperate with household farms and small industrial plants. In this way, a special combination of private and public interest developed.

As from the 1960-ies there was a general economic - at the beginning industrial - boom that had an enormous impact on the big estates, too. As wages were higher in industry, the rush towards industry was accelerated and the number of agricultural workers decreased markedly (20,6 percent in 1984, 37,7% in 1960). A significant concentration started, e.g. the number of state-farms was 333 in 1966, while it had decreased to 128 by 1984. During the same period the number of cooperatives decreased from 4507 in 1966 to 1279 in 1984. On the other hand their technical development was speeded up. The investments into buildings and equipment have increased by seven times, thus bringing about a quick and spectacular development of Hungarian agriculture.

From a spatial point of view it resulted in marked differences between the estates. Those with unfavourable potentials have clearly fallen behind. In order to reduce the regional differences, as from the early 1970-ies the big agricultural estates were allowed non-agrarian activities, too. This development coincided with decentralization politics for industry aiming at a utilization of cheap rural manpower. More and more industries were established within the big agrarian estates, thus guaranteeing more equal employment opportunities and stabilizing the economic situation of agricultural enterprises to a certain extent, and, having an accumulative effect, expediting the technical development in the agrarian sector as well.

The climax of development of these non-agrarian activities took place between 1975 and 1985, and its consequences can be summarized as follows:

1. Economic results:
   - the share of non-agrarian activities in the net income of agriculture increased from 25% to 40% and has become the economic base proper with one third of big agricultural estates.
   - The importance of the food-industry increased within the agricultural activities, but by 60% only between 1975 and 1985, while the income from commerce and services has tripled.

2. An increase of the technical level in agriculture and in the non-agrarian activites has changed the inner structure of the agrarian society fundamentally, the same is true of the traditional rural way of life (both on the private and the communal level). The number of white collar employees working in agriculture doubled during these 10 years, and reached 200,000. This group comprises non-agrarian workers mainly.

3. The spreading of non-agrarian activities resulted in unexpected spatial consequences. The possibilities of the new economy were mainly utilized by those big agrarian estates which were on the outskirts of towns or in the industrial belts, because both infrastructure and communication were better there and the vicinity of markets stimulated the development of new enterprises.

Thus, the non-agrarian activities did not lessen the regional differences formed earlier, but even increased them.

In spite of that, the phenomenon can, generally speaking, be said to be a favourable one, because the employment structure of rural areas was improved and, in this way, part of the rural society stabilized. The central settlements of agricultural estates have become innovation centres to some extent, incomes have improved greatly and there was some re-migration to agriculture. (The proportion of agricultural employees was 19,5% in 1980 and 20,6% in 1984!) There is no process of reorganization, though, but multi-functional characteristics of big agricultural estates are clearly visible.

ZUSAMMENFASSUNG

Seit der Umstrukturierung der Besitzverhältnisse der ungarischen Landwirtschaft 1960/62 haben Staatsgüter, Produktionsgenossenschaften und sog. "Fachgenossenschaften" (Beibehaltung des individuellen Bodenbesitzes in Weingebieten) auf etwas über 90% des Gesamtgebietes des Landes gewirtschaftet.

In der Gestaltung der Produktionsstruktur wurde den Großbetrieben - anders als früher - große Selbständigkeit gewährt. Sie konnten mit den Haus- und Kleinwirtschaftseinheiten eng zusammenarbeiten. Dadurch hat sich eine eigenartige Kombination von individuellem und Gruppen-Interesse herausgebildet.

Der für die 60-er Jahre charakteristische allgemeine - in der Anfangsperiode industrielle - Aufschwung hat auch auf die Großbetriebs-Wirtschaft eine entscheidende Wirkung ausgeübt. Infolge der höheren Löhne im Gewerbe ist die Abwanderung in die Industrie nun schneller geworden, der Anteil der Erwerbstätigen in der Landwirtschaft ist von 37,7% (1960) auf 20,6% (1984) zurückgegangen. So ergab sich eine bedeutende Betriebskonzentration:

	1960	1984
Anzahl der Staatsgüter	333	128
Anzahl der Produktionsgenossenschaften	4507	1279

Hinzu kam noch eine rasche technische Entwicklung, die Investitionen in Anlagen und Geräte sind auf das Siebenfache gestiegen. Das alles brachte die schnelle und sehr eindrucksvolle Entwicklung der ungarischen Landwirtschaft mit sich.

Diese Entwicklung wies jedoch starke regionale Unterschiede auf. Die unter ungünstigen Verhältnissen arbeitenden Betriebe sind hinter der durchschnittlichen Entwicklung immer weiter zurückgeblieben. Zur Aufhebung der regionalen Unterschiede wurde bereits seit Anfang der 70-er Jahre ermöglicht, daß die landwirtschaftlichen Großbetriebe auch nicht-agrarische Tätigkeiten ausüben können. Diese Tendenz fiel mit der Gewerbedezentralisierungs-Politik zusammen, deren Ziel in der Beschäftigung der billigen Arbeitskräfte in den Dörfern bestand. Immer mehr Industriebetriebe haben Betriebsteile in verschiedene Agrargroßbetriebe verlegt,

was sich als günstig erwies. Es ermöglichte eine ausgeglichenere Beschäftigungsstruktur und stabilisierte in gewissem Maße die ökonomische Lage der Agrarbetriebe. Letzten Endes hat dies auch zur technischen Entwicklung der Agrartätigkeit beigetragen.

Die rasche Entwicklung der nichtagrarischen Tätigkeit der landwirtschaftlichen Großbetriebe fällt in die Periode zwischen 1975 und 1985; die Konsequenzen sind wie folgt zusammenzufassen:

1. Wirtschaftliche Folgen:
   - Der Anteil der nicht-agrarischen Tätigkeit stieg im Netto-Einkommen der Landwirtschaft von 25% auf 40%; sie ist in einem Drittel der landwirtschaftlichen Großbetriebe der wesentliche Faktor für die wirtschaftliche Existenz geworden.
   - Innerhalb der nichtagrarischen Tätigkeit ist der Anteil des Lebensmittelsektors gestiegen, und zwar um 60% zwischen 1975 and 1985, das vom Handel und von den Dienstleistungen erwirtschaftete Einkommen ist demgegenüber dreimal größer geworden.
2. Das erhöhte technische Niveau und der Zuwachs an nicht-agrarischen Tätigkeiten der Landwirtschaft hat die innere Struktur der Agrarbevölkerung und damit auch die traditionelle dörflich-bäuerliche Lebensweise tiefgreifend verändert. Die Anzahl der in der Landwirtschaft tätigen Angestellten hat sich während der erwähnten zehn Jahre verdoppelt und ist auf etwa 200 000 gestiegen. Diese Gruppe umfaßt in erster Linie die nichtagrarische Tätigkeiten ausübenden Personen.
3. Die Verbreitung der nicht-agrarischen Tätigkeit hat unerwartete territoriale Konsequenzen mit sich gebracht. Die neuen Wirtschaftsmöglichkeiten konnten nämlich vor allem von den landwirtschaftlichen Großbetrieben in der Umgebung von Städten und der Industriezonen ausgenutzt werden, weil sie infrastruktur- und kommunikationsmäßig besser versorgt waren als der Durchschnitt. Auch bessere Marktverhältnisse haben diese Betriebe günstig motiviert.

Die Verbreitung der nicht-agrarischen Tätigkeit hat die bestehenden regionalen Unterschiede nicht behoben, sondern relativ eher verstärkt.

Trotzdem kann diese Erscheinung positiv beurteilt werden, weil sie die Beschäftigungsstruktur der Dörfer verbessert und damit einen Teil der Dorfgesellschaften sogar stabilisiert hat. Die Siedlungen der landwirtschaftlichen Betriebszentralen sind zu Innovationszentren geworden. Auch die Einkommensverhältnisse haben sich gebessert. All dies führte zu einem gewissen Rückstrom der Agrarbeschäftigten (Anteil 1980 19,5%, 1984 20,6%). Das bedeutet aber keinesfalls einen Reagrarisierungsprozeß, sondern weist auf den Mehrfunktionscharakter der landwirtschaftlichen Großbetriebe hin.

* * *

1. INTRODUCTION

During the period of 1975-1985 the transformation of the production structure of the agricultural big farms accelerated.

Table 1 Index numbers of the gross production of the agricultural sector 1960 = 100

	Plant cultivation	Animal husbandry	Agricult. products	Agricultural activities basic	Agricultural activities others	All activities
			State farms			
1975	187	194	188	196	539	222
1984	216	292	250	299	2 257	440

			Agricultural co-operatives			
1975	202	348	232	240	1 274	295
1984	269	531	325	344	3 082	489

The increase in the so-called "other agricultural activities" comprising industrial and commercial acitivities and services, is particularly conspicuous. At the time of the emergence of new possibilities for activities for the big farms, the economic conditions differed widely, therefore it was assumed that the phenomenon would develop in different way regionally and consequences would vary as well. Thus, in this study an attempt is made to present a survey of the *regional differences* in the non-agrarian activities of the big farms and their (local and regional) *social consequences*. It is not possible to describe the network of economic and social relationships of the phenomenon in full here, therefore only the problems as such and its economic and social background is referred to in certain respects.

The rate of formation and strengthening of the branches of non-agrarian activities can be understood only against the background of the specific developments in agriculture, therefore at least the main phases of development ougth to be referred to.

2. MAIN PHASES OF THE DEVELOPMENT OF AGRICULTURE BETWEEN 1960-1985

In 1985, agriculture contributed 20.3% of the net production of the national economy and had a share of 22.7% in exports. The spectacular development of agriculture during a quarter of a century (1960-1985) on the other hand was accompanied by a simultaneous decrease of the agricultural area by half a million hectares and a reduction of the number of employees by 700,000.

Characteristics of the main phase of agrarian development:
First half of the sixties: change in the operating conditions, above all: organization of big farms. It is generally accepted that the attempts made in the fifties had had no success, and it had become evident that a rather strictly defined producing organization was not suitable for the Hungarian productional tradition, the human and community interests. Therefore, between 1960 and 1962 business was reorganized according to the following principles:

- It became possible to organize big farms of different type and thus, e.g., in the grape growing regions both *state farms* with state-owned landed property and the *specialized co-operatives*, with private landed property, were founded.
- Though the land was no longer private property in the *production co-operatives* it was possible to cease being a member of the co-operative and get back one's land. Its members on the other hand, received an allowance according to their former property. It is even more important that each member of the co-operative was entitled to an individual leasehold,

the extent of which being determined by the membership of of the co-operative.

Obviously this and other, later on increasingly important forms of combining co-operative and individual interests created the basis for the introduction and operating of non-agrarian activities.

From the plans for the economic reform of 1968 till the middle of the seventies the development of agriculture as a purely "primary activity" was most spectacular. The reasons for this were manifold:

- As from the middle of the sixties on the one hand, there was a trend towards concentration in order to utilize agricultural investments optimally. Thus, both the interests of economic branch policy and business management grew to such proportion that central intervention became necessary, though this concentration definitely resulted in a very efficient utilization of the means available (ENYEDI, I. 1983).

Table 2 Number of agricultural enterprises

	State farms	Co-operatives	Specialized co-operatives
1960	333	4 507	196
1984	150	1 598	61

Concentration had been necessitated large-scale labour migration during this period and the newly created possibilities of mechanization.

- In this period of mechanization proper in agrarian production, the present conditions of the infrastructure of production were established. At the beginning of the seventies the big farms invested three or four times more annually than they had done in the middle of the sixties.
- After 1968 the independence of the big farms was strenghtened further. As a result, common and household production developed in a similar way, and highly diversified forms came into existence. Thus there was a marked distribution of labour between the common and household (individual) undertakings, with the former focussing on mechanized plant production (e.g. foodstuff production) and the household farms on keeping small livestock. Both these common farms and individual production units were protected by different contracts. Thus, 70 to 80% of the foodstuff was produced by the big farms and about half of the animal products by the small farms which, of course, operated on the basis of conctracts concluded with the big farms. To my mind it was the combination of these three factors, namely big farms, technical infrastructure and individual undertakings, that have made possible a process of spreading non-agrarian activities.

As from the middle of seventies, the non-agrarian activities of the big farms were being supported by economic and social policy measures as well. The reasons for this can be summed up as follows:

- In the earlier phase of rapid development the economic - and consequently, regional - differences between the big farms had increased. Those in areas with unfavourable natural conditions had fallen behind the others, a development resulting in social disadvantages locally and, thus, a growing out-migration from the respective regions.
- Marked regional differences were caused by plant concentration, too, because those settlements, in which the headquarters of the plant were established gained considerable advantage with becoming centres of small regional units. At the same time, the smaller settlements definitely fell back. The regional economic differences formed in this way became a source of social tensions.

Economic and social policy saw a solution for these problems in a levelling of the regional differences by industrializing the countryside, i.e. a "vertical developing" of agricultural production (BARTKE, I. 1986).
Central management and public opinion agreed that it was advisable for the big farms to undertake wider range of activities and to become effective economic bases of the smaller regions in this way.

3. REGIONAL AND SOCIAL CONSEQUENCES OF THE DEVELOPMENT OF NON-AGRARIAN FUNCTIONS FOR BIG FARMS

As from the middle of the seventies non-agrarian activities (manufacture, building, whole sale, services etc.) spread quickly and in 1984 these activities constituted the main branch already with 17% of the big farms, i.e. provided more than 50% of their incomes. At the beginning of the seventies the big farms either took over industry formerly allocated in the cities, or were able to provide employment locally, thus slowing down out-migration. Due to the industrial recession setting in in the seventies the big farms concentrated, to an increasing extent, on branches using basic materials available locally (food or wood processing etc.) and the sale of their produce. The participation in tertiary sector developed particularly quickly, with a freer moving of capital in the co-operative sector playing a role, too.

3.1. Regional conequences

The hope of improving the economic situation of the big farms working in areas with unfavourable conditions by developing of non-agrarian functions came true partly only, as the new possibilities could be utilized primarily by the plants situated near urban-industrial agglomerations. Therefore, 70% of the farms with a non-agrarian function as nowadays the "leading branch" can be found in three of Hungary's 19 counties - Pest, Bács-Kiskun and Borsod-Abaúj-Zemplén - which belong to the more economically developed regions, but for the district of the county Borsod-Abaúj Zemplén on the border.

The "traditional" plant-growing and cattle-breeding farms, in particular those with unfavourable conditions, could profit from these new possibilities marginally only, the reason for this being mainly that the village regions of mountainous and hilly character, e.g. the southern part of Transdanubia, the south-western part of Transdanubia, Nógrád etc., are characterized by hamlets, a bad infrastructure, and, being situated far away from the urban-industrial agglomerations, these areas are shut off from the traffic. During the period of marked migration between 1960 and 1970 they moreover lost a considerable part of their active population. This selective migration resulted in a social deformation (marked aging, manpower unskilled to a hight extent etc.), thus, nowadays, the innovative capability of these regions is seriously impaired.

The non-agrarian functions could not become a powerful branch in the big farms of the Great Hungarian Plain either, but here the situation is fundamentally different. The big farm, in general, have good quality arable land, production is mechanized to a high degree, and there is intensive production. Thus, on the whole the farms are profitable and there is no need to introduce non-agrarian activities. On the other hand the settlements on the Great Hungarian Plain are large and have industry of small and medium size as well. Therefore, changes in the occupational structure or migration have not caused such a social deformation as in the areas of hamlets. The infrastructure of the settlements is more favourable, the general level of supply is better. Because of the presence of both agriculture and industry it became general practice to hold two jobs in these settlements resulting in at least average personal incomes and, in certain cases (grape-growing regions) in extremely high personal incomes. Therefore out-migration did not only slow down, but in certain areas there even was re-migration to the region.

The big farms in which the non-agrarian activities are the leading branch, fall into three groups *(Fig. 1)*:

- Farms situated within the metropolitan agglomerations - first of all Budapest and Miskolc - have developed the tertiary sector, and production aims to satisfy the demands of the cities.
- The farms disposing of a special crop (grapes, fruit, vegetables etc.) belong to the third type, with a food industry based on their own produce.

3.2. *Social consequences*

The social effects of the spreading of non-agrarian functions are not of local significance only.

Regarding the individual settlement it undoubedly had a favourable effect, because

- the farms being able to add to their industrial and commercial activities ensured a higher average income for the employed and thus was able to retain younger manpower. The new activities required a higher qualification also, therefore an 'upper' strata of the villages' society remained intact.
- The presence of industrial and commercial functions established contacts with the towns, therefore these farms represent specific urbanized nuclei in the village region.

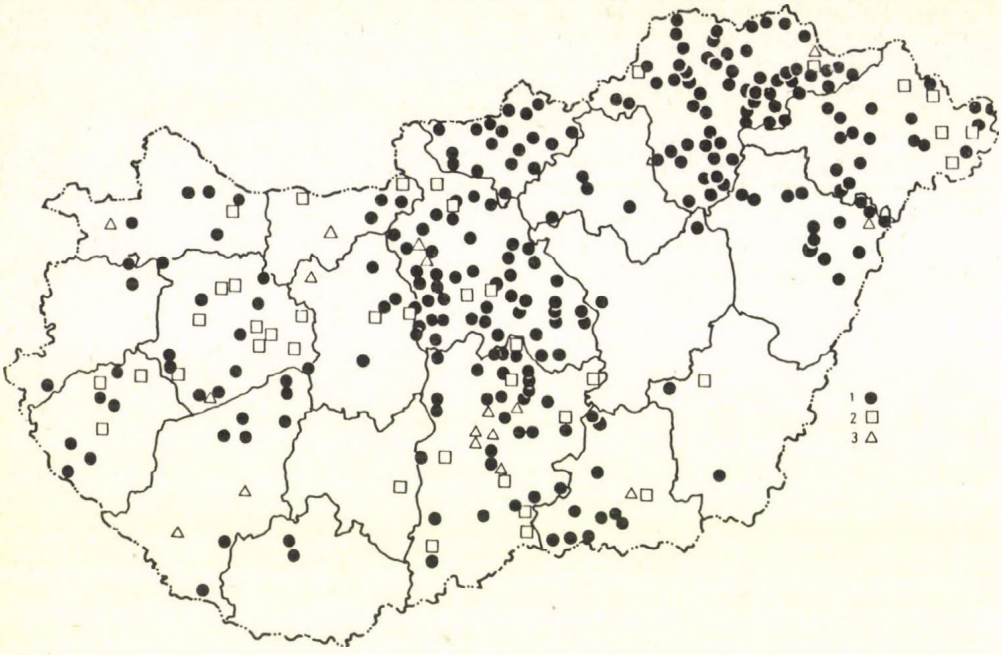

Figure 1 Large agrarian estates characterized mainly with non-agrarian activities

1 = agrarian co-operatives; 2 = state farms; 3 = special co-peratives

At the same time these relationships promoted a renewal of the basic activity as well, and thus a certain innovative role was allotted to the farms, namely transmitting new production processes small-scale enterprises.

- By the non-agrarian activities both the management of the big farms and even the individual employees had to develop a high degree of openmindedness and even adopt an "entrepreneur's attitude. As the risks had to be taken jointly, this fact contributed considerably to a strenghtening of democratism at the work place and, also within the community in general. It was not mere chance that the election of the "leaders" presented us problem with these farms.
- The market-oriented production "produced" leaders that were "managers" proper, with their authority resulting from professional skill and inventiveness.

Regional social consequences beside the local ones became obvious in particular by the beginning of the eighties. Thus they can be said to be related to the non-agrarian activities partly.

- The *occupational structure* took on an "urbanized" character in those big farms of the urban and industrial regions that had an opportunity to join the tertiary sector or industry. In these big farms, the *proportion of white collar employees amounts to approx. 17%, and about 40,0 to 45,0% of the manpower work in industry*. Therefore, in these big farms for only about 60% of the manpower village style life is not necessary.
- People *employed in the industrial "auxiliary" plant of the big farm* are dependent on the basic activity through the animal breeding, grape and fruit cultivation, or horticulture though, therefore they have double incomes, but they do not invest the surplus income for the expansion of the household plots, but for improving the standard of living and increasing consumption.

  This group occupies a peculiar intermediary position in the social hierarchy between the agrarian and industrial sectors, being neither farm workers nor workers living at the periphery of the agrarian or industrial sector, their activities being a function of the actual market conditions and possibilities for earning extra money. At the same time they are perfectly willing to belong to a co-operative, to become members even of the co-operative in the majority of the cases, in order to enjoy the economic advantages being connected with it (household plots, regular feedstuff supply and chances for product purchasing etc.). In official statistics, membership in a co-operative is counted as "agricultural occupation", though in reality about 30% of the members carry out an industrial activity. From this paradox situation it follows that the proportion of the agriculturally employed increased(!) e.g. in the agglomeration of Budapest, between 1960 and 1980, though the socio-economic process actually was the other way round, but as this process developed partly within the framework of the agrarian sector, of course, the number of "its" employed increased.

  From another viewpoint those who had migrated to the periphery of the city increased the number of "agriculturally employed", too, though - as our investigations have confirmed - in fact they are working in the "auxiliary plants" of industrial character bound up with big farms, often factory units of large-scale Budapest companies located there.
- *The white collar employees of the big farms* have scarcely any ties with the agrarian sector anymore, the rate of those having a household plot is between 5-10% only. Moreover these employees of the farms situated in the vicinity of the big cities are not even living there, but are commuting to work from the town. These circumstances are disadvantageous for the development of the small local communities, because an intellectual class supplying a pattern for living is missing, and the blue collar employed, too, see a chance for social climbing in the "town". This attitude is strengthened - even within the urban regions - by an insufficient infrastructure (BERÉNYI, I. 1986).

The effect of the non-agrarian activity can be detected also in the *average monthly incomes achievable in the big farms.* As a consequence , the regional differences mirror those of the professional structure.
Both blue and white collar employees can reach an avarage income at the big farms which have an auxiliary activity of an industrial, commercial or service character that is 30% above the national average.
The differences plotted on the basis of employment and average incomes indicate that the new functions (industrial or commercial activities, services) primarily put those big farms situated in urban and industrial areas in an advantageous position,. There living standards not only did not become lower, on the contrary, certain cases they even improved. It is quite evident that big farms dispose of very different possibilities for such a development. Obviously a more differentiated economic policy and system of economic means is required to give those economic organizations working under unfavourable conditions a chance for introducing innovations.

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SOME PROBLEMS OF SMALL TOWNS IN THE GREAT HUNGARIAN PLAIN

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SUMMARY

With respect to the special settlement-system of the Great Hungarian Plain, settlements of 10-30,000 inhabitants can be considered small towns. There are some cases with an even smaller population, having certain central and local functions. Therefore, altogether 63 small towns or settlements of the same rank were included into this survey.

It is not the aim of this essay to describe the complexity of the problem of small towns, but to look at some aspects of the demographic and housing conditions.

Taking into consideration the changes in population, a remarkable fluctuation is to be noticed between 1949 and 1983. There was an increase during the 1950-ies, and a significant decrease during the 1960-ies, while an increase can be registered again between 1970 and 1980. A more marked decrease started at the beginning of this decade again, and it seems to be a long-term one. The process differs widely in a spatial context: There are large differences as to the population development between the various small towns. On the whole a loss of population was characteristic mainly for the southern part of the Great Hungarian Plain.

Natural growth of the population and migration contributed to an increase of the population figures in the small towns in different ways. During the period examined two processes were typical: a decrease of the birth-surplus on the one hand and an improvement of the migration-balance on the other hand. But migration stopped at the turn of the 1980-ies in the Great Hungarian Plain, and the tendency towards a concentration of the population in the small towns seemed to decrease.

Considering that population figures have been decreasing in several small towns in the Great Hungarian Plain, the following question arises: Can this be explained as a sign of decline? Generally speaking this is not true, but there definitely are a few small towns in which the loss of population constitutes a threat for a viable socio-economic structure.

One of the signs for this is the unfavourable trend as to age-structure. During the 1970-ies, there was a certain improvement of the age-structure even in small towns, but from the beginning of the 1980-ies this process was stopped, and an increasing number of small towns are threatened by the danger of "ageing".

The examination of dwelling conditions has some obvious problems, too. As a consequence of the short "urban history", the age of dwellings is rather favourable in the small towns, but there are disadvanteges on the other side as well, because bad-quality materials were used, mainly for the flats built before 1945.

For the past few decades, an improvement of dwelling conditions is the characteristic feature, although spatial differences are outstanding in this respect, too. This is true not only as to the age and location of the flats, but as to the increase in the number of flats that are bigger and better equipped.

Nevertheless there is no fundamental change as yet as far as the dwellings are concerned in the small towns of the Great Hungarian Plain in spite of these developments.

ZUSAMMENFASSUNG

Aufgrund der speziellen Siedlungsstruktur sind in der Großen Ungarischen Tiefebene die Siedlungen mit einer Einwohnerzahl zwischen 10 000 und 30 000 als Kleinstädte zu betrachten, in einigen Fällen gehören sogar Siedlungen mit noch geringerer Einwohnerzahl, jedoch mit zentraler Funktion, dazu. So wurden insgesamt 63 Kleinstädte bzw. kleinstädtische Siedlungen untersucht.

In der Studie soll das Kleinstadt-Problem nicht vollständig erfaßt werden, sie hat vielmehr eine Übersicht über einige Aspekte der Demographie und der Wohnungsverhältnisse zu geben.

Was die Einwohnerzahl anbelangt, ist zwischen 1949 und 1983 eine bedeutende Schwankung zu merken. In den 50-er Jahren erfolgte eine Steigerung und in den 60-er Jahren ein wesentlicher Rückgang, zwischen 1970 und 1980 war wieder ein Zuwachs zu registrieren. Anfang der 80-er Jahre begann nun ein wohl langfristiger Rückgang in der Einwohnerzahl. Dieser Verlauf erscheint allerdings territorial differenziert; so ergeben sich wesentliche Unterschiede in der demographischen Entwicklung der einzelnen Kleinstädte. Zusammenfassend konnte festgestellt werden, daß der Rückgang der Einwohnerzahl in den Kleinstädten im Süden der Ungarischen Tiefebene am prägnantesten war.

In der demographischen Entwicklung der Kleinstädte spielten der natürliche Zuwachs und die Abwanderung eine sehr unterschiedliche Rolle. Für die untersuchte Periode waren grundsätzlich zwei Prozesse charakteristisch: Minderung des Geburten-Überschusses und Verbesserung der Abwanderungsbilanz. In der Anfangsperiode der 80-er Jahre kam es aber auch bei der Abwanderung zu einer Verstärkung, anscheinend ging also die bevölkerungskonzentrierende Kraft der Kleinstädte der Tiefebene zurück.

Nachdem ein Rückgang des Einwohnerzahl in Kleinstädten immer öfter festgestellt wurde, ergab sich die Frage, ob das nun Zeichen eines Verfalls seien. Das kann zwar nicht generell behauptet werden, es gibt jedoch schon mehrere Kleinstädte in der Ungarischen Tiefebene, in denen der Einwohnerverlust die Lebensfähigkeit der wirtschaftlich-sozialen Struktur gefährdet.

Ein prägnantes Zeichen dafür ist die zunehmend ungünstigere Altersstruktur. In den 70-er Jahren gab es noch eine gewisse Besserung in der Altersstruktur der Einwohner der Kleinstädte, dieser Prozeß wurde jedoch Anfang der 80-er Jahre unterbrochen; in immer mehr Kleinstädten droht die Gefahr der Überalterung.

Auch die Untersuchung der Wohnungsverhältnisse hat einige Probleme erkennen lassen. Dank der relativ kurzen städtischen Entwicklung ist zwar die Altersstruktur des Wohnungsbestandes der Kleinstädte verhältnismäßig günstig, doch die nicht ausreichende Qualität des Baumaterials - besonders bei den Wohnungen, die vor 1945 erbaut worden sind - sehr von Nachteil.

In den jüngst vergangenen Jahrzehnten scheinen sich die Wohnungsverhältnisse gebessert zu haben. Allerdings sind die regionalen Unterschiede auch in dieser Frage sehr ausgeprägt. Diese gewisse Besserung bezieht sich nicht nur auf die Altersstruktur und den Zustand des Wohnungsbestandes, sondern auch auf die Größe und die Ausstattung der

Wohnungen. Zusammenfassend kann festgestellt werden, daß auf dem Gebiet der Wohnungsverhältnisse in den Kleinstädten der Ungarischen Tiefebene insgesamt keine grundsätzliche qualitative Änderung zustandegekommen ist.

* * *

1. INTRODUCTION

Ideally, the settlement hierarchy of a country can be described as pyramidal: rural settlements in large numbers form the base, small towns exist in considerable numbers still, while there are relatively few towns of medium size. Some cities follow, with the capital at the top. This ideal picture, however, very seldom occurs in reality, since there are elements in the settlement system of each country that deviate from this scheme. In Hungary the small towns belong to this class at present, particularly in the rural areas (KÄNEL, A. v. 1984, WEBER, E. 1984). In geographical literature little mention is made of the problems of these settlements, although well-appointed small towns are important features of a regular settlement network (CLOKE, P. 1979).

The present paper, as a matter of course, does not intend to give a comprehensive picture of each of the problems in the small towns of the Great Hungarian Plain, the main purpose is rather to call attention to them. In the specific settlement system of the Great Plain, the cateogry of small towns comprises settlements with 10,000-30,000 inhabitants as well as smaller ones on condition that they have some local central functions. Thus, 63 settlements belong to the class of small towns and settlements of small town character.

2. POPULATION GROWTH

Betwen 1949 and 1980 the *changes in the numbers of inhabitants* can be traced primarily by means of census data. In this period the population figures of the settlements studied showed considerable fluctuations: in 1949, 790,600 people lived there, a population of 795,800 was reached by 1960, then a remarkable decrease followed (783,500 inhabitants in 1970), and growth again in the 70s (805,200 inhabitants in 1980).

This process did, however, vary highly regionally. The extreme cases were represented by the counties of Szabolcs-Szatmár and Békés: in the first case there was a continuous growth in population, while in Békés, population declined permanently from 1949 to 1980 (DÖVÉNYI, Z. 1984). The other counties were mostly characterized by population losses in the small towns during the 60s, followed by another period of growth *(Fig. 1)*.

Natural growth and *migration* have played different roles in the population history of the small towns. There are two distinct processes characteristic of the period investigated:

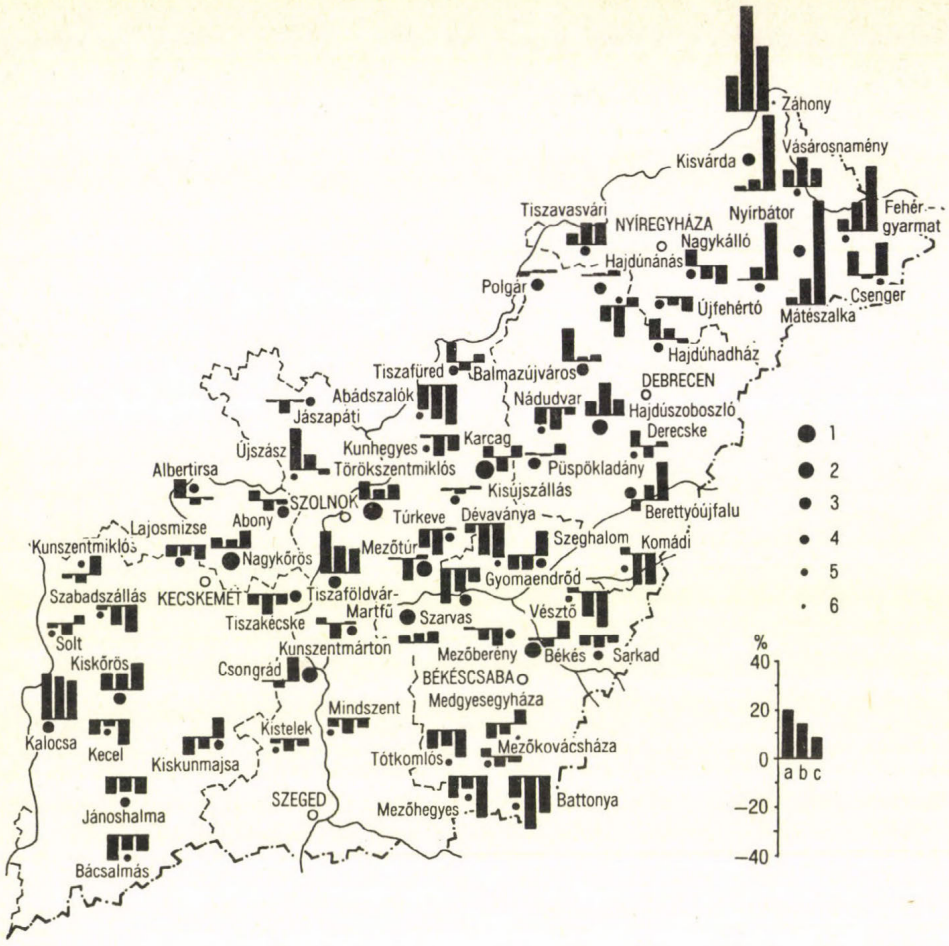

Fig. 1 Population growth in the small towns in the Great Hungarian Plain (1949-1980)

Population numbers (1980): 1 = above 25 000; 2 = 20 000-25 000; 3 = 15 000-19 999; 4 = 10 000-14 999; 5 = 5000-9999; 6 = below 5000

Investigation periods: a = 1949-1960; b = 1960-1970; c = 1970-1980

one is the reduction in birth surplus, the other is an improvement of the migration balance. Between 1949 and 1960 natural growth was observed for all the small towns, while migration led to losses but for Kalocsa, Tiszaföldvár-Martfü and Újszász. The losses through migration amounted to more than 2000 people in some of the small towns (DÖVÉNYI, Z. 1983).

Outmigration generally decreased during the 60s, but the reduction of the birth surplus was much more rapid. In that decade there were the first small towns with natural loss (Battonya, Tótkomlós, Békés, Szarvas, Csongrád, Mindszent and Jánoshalma). The owerwhelming majority of the settlements studied

presented, however, migration deficits and a very significant one in some cases, too (for Újfehértó 3,746, for Hajdúnánás 3,176, and for Dévaványa 3,136 people). On the other hand the number of small towns with a migration surplus also increased (Kalocsa, Szarvas, Nagykörös, Berettyóujfalu, Hajdúszoboszló, Záhony and Tiszaföldvár-Martfű).

During the following period (1970-1980) the trends in the natural changes of population changed little only. In some settlements natural decrease was observed (as in Battonya, Tótkomlós, Csongrád, Kistelek, Jánoshalma, Kecel and Újszász), but these losses were insignificant. In contrast, the migration balance improved considerably. In many small towns this improvement only meant a great reduction in outmigration (even the largest migration loss below 2000 people), but in an increasing number of cases a positive balance came about: there were 21 such small towns altogether and 10 with higher migration surplus than natural growth (Békés, Szarvas, Solt, Kalocsa, Kiskörös, Berettyóújfalu, Kisvárda, Mátészalka, Nyírbátor and Fehérgyarmat *(Fig. 2)*.

In the early 80s another disadvantageous process started, however. The population of Hungary has been decreasing since 1981. This process naturally effects the small towns of the Great Plain, too. Early in 1983 the settlements had a population of around 80,000, and there was a general deterioration in the demographic conditions (DÖVÉNYI, Z. 1986).

In the study of population changes in the small towns of the Great Plain, not only total population but the population of the inner areas also is important. A considerable proportion of the small towns had been surrounded by tanyas (scattered farmsteads) once; during the last decades mainly the population of the tanyas and of the outskirts has decreased remarkably. Therefore, in several small towns the decrease of population resulted from that decline, and the number of people living in the inner areas did not decrease. In 1980 in 13 small towns the proportion of the outskirts' population was still above 10 per cent, but in several cases the population of the inner area of these settlement increased. Consequently, the situation appears more favourable if we also regard the changes in the population of the inner area.

Another problem should be mentioned in connection with the above statements: Is this decrease of population and indication of general decline? The answer is: Not necessarily, since, as a result of socio-economic changes, the number of inhabitants often undergoes changes and adjustments to the new situation. If a settlement is able to maintain a healthy socio-economic structure, population loss cannot be considered a sign of decline.

Things are different for the small towns of the Great Plain. Population loss here often affected the *age structure* adversely. There were considerable differences between the settlements studied in this respect, too. The ratio of children was more favourable here than the national average (23.3 per cent), while that of population capable of work was only 59.1 per cent *(Fig. 3)*.

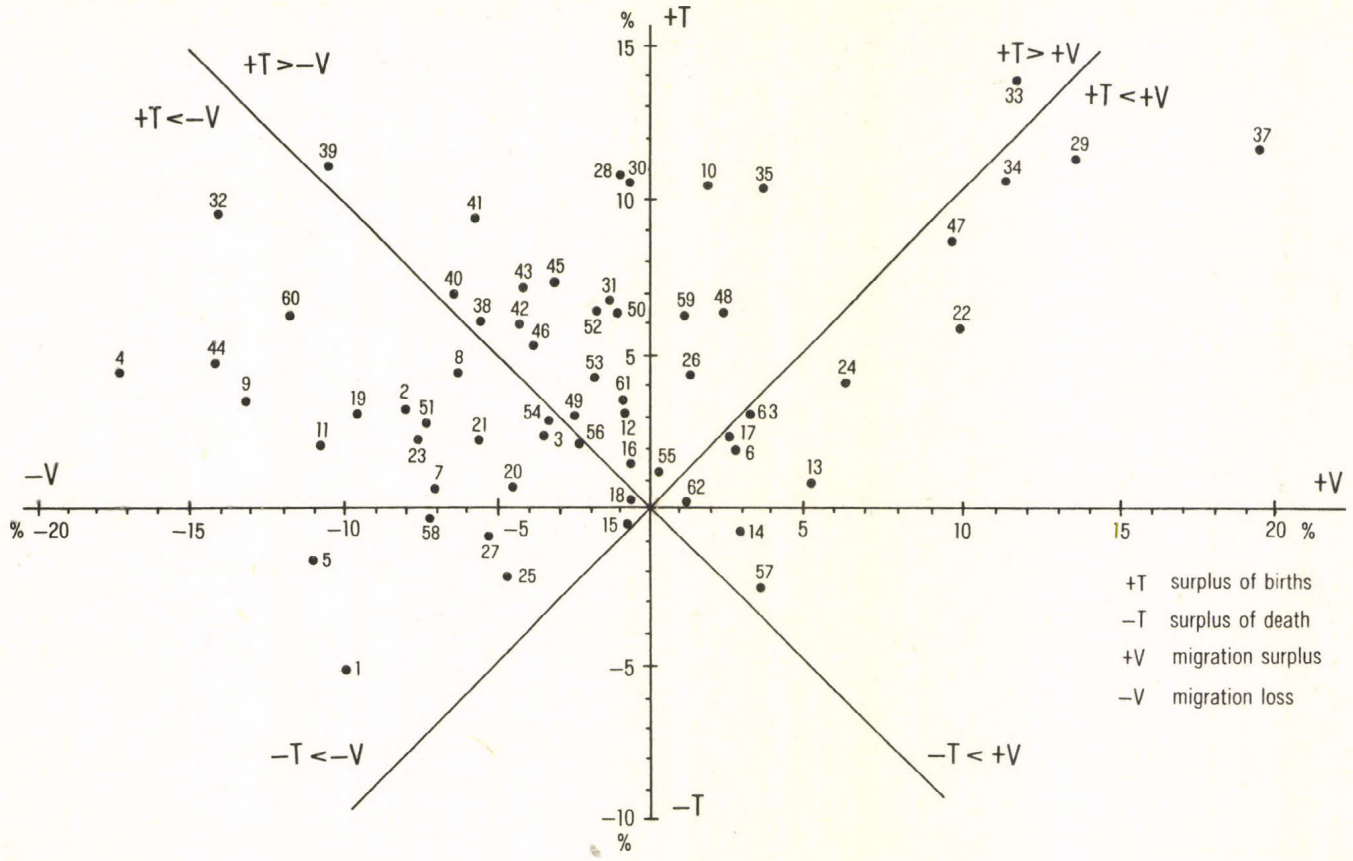

Fig. 2 Characteristic features of population development and migration in small towns of the Hungarian Great Plain

Register of place names

1. Battonya
2. Medgyesháza
3. Mezökovácsháza
4. Mezöhegyes
5. Tótkomlós
6. Békés
7. Mezöberény
8. Sarkad
9. Dévaványa
10. Szeghalom
11. Vésztö
12. Gyomaendröd
13. Szarvas
14. Csongrád
15. Kistelek
16. Mindszent
17. Solt
18. Tiszakécske
19. Szabadszállás
20. Bácsalmás
21. Lajosmizse
22. Kalocsa
23. Kiskunmajsa
24. Kiskörös
25. Jánoshalma
26. Kunszentmiklós
27. Kecel
28. Vásárosnamény
29. Fehérgyarmat
30. Nagykálló
31. Tiszavasvári
32. Újfehértó
33. Záhony
34. Nyírbátor
35. Csenger
36. Mátészalka
37. Kisvárda
38. Derecske
39. Hajduhadház
40. Nádudvar
41. Balmazújváros
42. Hajdúdorog
43. Hajdúnánás
44. Komádi
45. Püspökladány
46. Polgár
47. Berettyóújfalu
48. Hajdúszoboszló
49. Mezötúr
50. Törökszentmiklós
51. Kunhegyes
52. Karcag
53. Kisújszállás
54. Jászapáti
55. Kunszentmárton
56. Túrkeve
57. Újszász
58. Tiszaföldvár-Martfü
59. Tiszafüred
60. Abádszalók
61. Abony
62. Albertirsa
63. Nagykörös

Through a coincidence of several factors, there was a 'baby boom' in Hungary. This demographic peak also affected the small towns: In 1980 children amounted to 23.7 per cent and retired people to 17.1, and this indicates an improvement of the age structure. An especially positive phenomenon was this change in those small towns, too, where the proportion of old people is highest. The improvement, however, did not last long and the age structure began deteriorate as early in the 80s already (DÖVÉNYI, Z. 1986).

3. DWELLING CONDITIONS

In the small towns of the Great Plain the *age of dwellings* is relatively favourable. The main reason for this is that these settlements do not have long urban traditions and, thus, buildings dating back to the late Middle Ages are almost completely missing. Another feature to be mendioned refers to

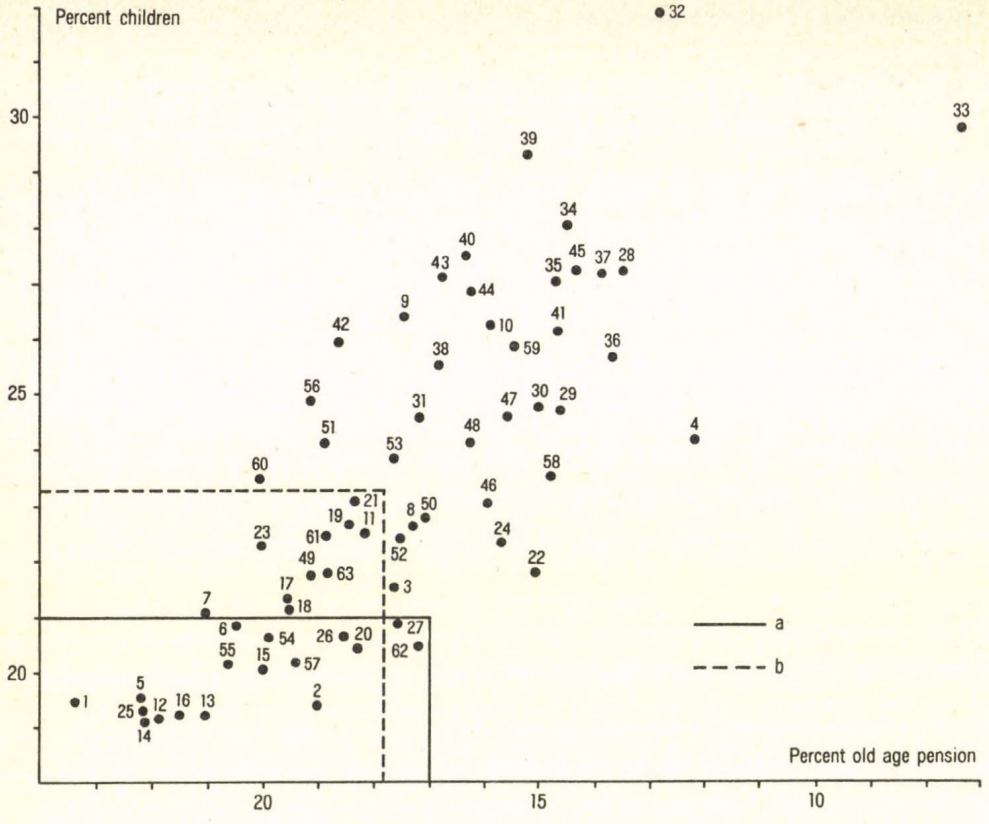

Fig. 3 The age structure in small towns of the Great Hungarian Plain (1970) (for numbers, cf Fig. 2)

a = Hungarian means; b = means of the small towns of the Great Hungarian Plain

building materials. Formerly the most important building material was adobe, and wattle walls were characteristic. As a consequence, the lifespan of houses was much shorter than of those built of brick or stone.

When investigating the situation in 1970, it was found that one quarter of the dwellings of the small towns had been built before 1900, but regional differences were considerable. The ratio for Szabolcs-Szatmár county was only 10.6 per cent, but that of Békés county over 30 per cent. Seven small towns stood out with a ratio of 19th century dwellings in the above 40 per cent range in 1970. Among them settlement with longer urban traditions were also to be found (such as Túrkeve: 52.8 per cent, Nagykörös: 42.8 per cent, Karcag and Kisújszállás: 42.3 per cent). The other extreme was represented by the six small towns where the ratio of dwellings built before 1900 amounted to less than 10 per cent (Záhony: 3.9 per cent, Vásárosnamény 6.6 per cent and Újfehértó: 8.7 per cent). With the exception

of Újszász, all these settlements are located in Szabolcs-Szatmár county.

In 1970 41.3 per cent of the dwellings of small towns had been built between 1900 and 1944. In this category, no major differences were to be observed between the counties.

In 1970 the overall ratio of dwellings built between 1945 and 1959 was 14.6 per cent, but the regional differences here are rather significant: the extremes are Szabolcs-Szatmár county (24.5 per cent) on one hand and Csongrád county (8.9 per cent) on the other hand. Large-scale housing developments took place in Záhony (34.0 per cent), Vásárosnamény (32.8 per cent) and Mezöhegyes (31.3 per cent) during that period, while in 16 small towns the ratio of dwellings from those years remained below 10 per cent. Such settlements frequently occur among the former market towns and are characteristic, first of all, of Békés and Szolnok counties (six and four small towns, resp.).

During the 60s the rate of construction of dwellings also grew in the small towns of the Great Plain. The ratio of dwellings built during this decade was 18.4 per cent on average in 1970, but in Szabolcs-Szatmár it was as high as 23.5 per cent, in Hajdú-Bihar 23. per cent, but only 12.8 per cent in Békés county, which indicates the decline of small towns here. The ratio of dwellings built in the 60s remained below 10 per cent in six small towns of the Great Plain: half of them were in Békés county (DÖVÉNYI, Z. 1983).

Considering the data for 1980, dwelling seemed to "get substantially newer". A major drop is observed in the ratio of dwellings built before 1900 (16. per cent) and in Szabolcs-Szatmár county a mere 5.3 per cent of the total dwelling of small towns had been built in the last century. In this county the figure for all small towns remained below 10 per cent, but in other counties five settlements were found with ratios above 30 per cent still.

The ratio of dwellings built between 1900 and 1944 also decreased remarkably and sank below 30 per cent by 1980. The share of dwelling constructed between 1945 and 1959 was also reduced, although it still exceeded 10 per cent. The fall in the ratio of the dwellings built before 1960 indicates the acceleration of housing development activities since the 60s, resulting in the ratio of dwellings built between 1960 and 1979 rising to 43.6 per cent. The figures for the counties did not differ considerably (the range was from 37 to 40 per cent), only Szabolcs-Szatmár had a higher value (58.2 per cent). There were altogether 19 small towns where more than half of the dwellings had been built after 1960. Fehérgyarmat reached 80.8 per cent even, but in this case the floods in 1970 played a major role, since most of the old dwellings had been destroyed then.

On the whole, the number of dwellings in the small towns of the Great Plain showed a 10.7 per cent increase from 1970 to 1979. In five settlements more than 2000 new dwellings were built during that decade (Békés: 2820, Nagykörös: 2526 and Hajdúszoboszló: 2482), and the period might be considered as favourable as to housing development in general. It is necessary to note, however, that the opportunities for building activities

were highly different for the individual small towns of the Great Plain. Only a minority of the settlements received state subsidies for housing projects, while elsewhere only private housing was feasible *(Fig. 4)*.

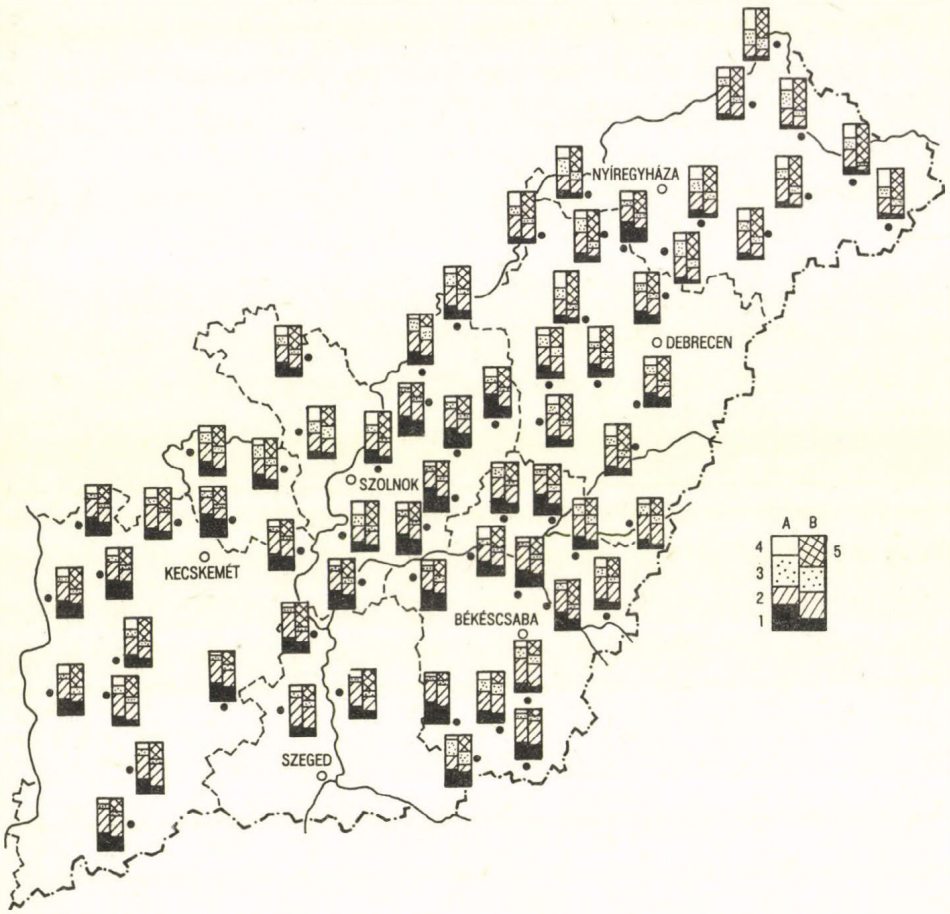

Fig. 4 Building age of flats in the small towns of the Great Hungarian Plain

A = 1970; B = 1980; 1 = built before 1900; 2 = 1900-1944; 3 = 1945-1959; 4 = 1960-1969; 5 = 1970-1979

For assessing the actual dwelling conditions in the small towns, other indicators are also necessary in addition to age structure. Some orientation is provided by

- the number of people per 100 dwellings and
- the ratio of dwellings with three or more bedrooms.

In 1970 the number of people per 100 dwellings was between 290 and 350 in the small towns of the Great Plain. The ratio of dwellings with three or more bedrooms was low, generally

below 10 per cent, and housing conditions were unfavourable in several small towns, among others, in several settlements of Szabolcs-Szatmár county, where the number of people per 100 dwellings was still above 350, in spite of the considerable efforts in housing development. The other extreme was represented by the small towns where a loss of population resulted in a low value for the above indicator. Such settlements primarily occurred in Békés and Bács-Kiskun conties *(Fig. 5)*.

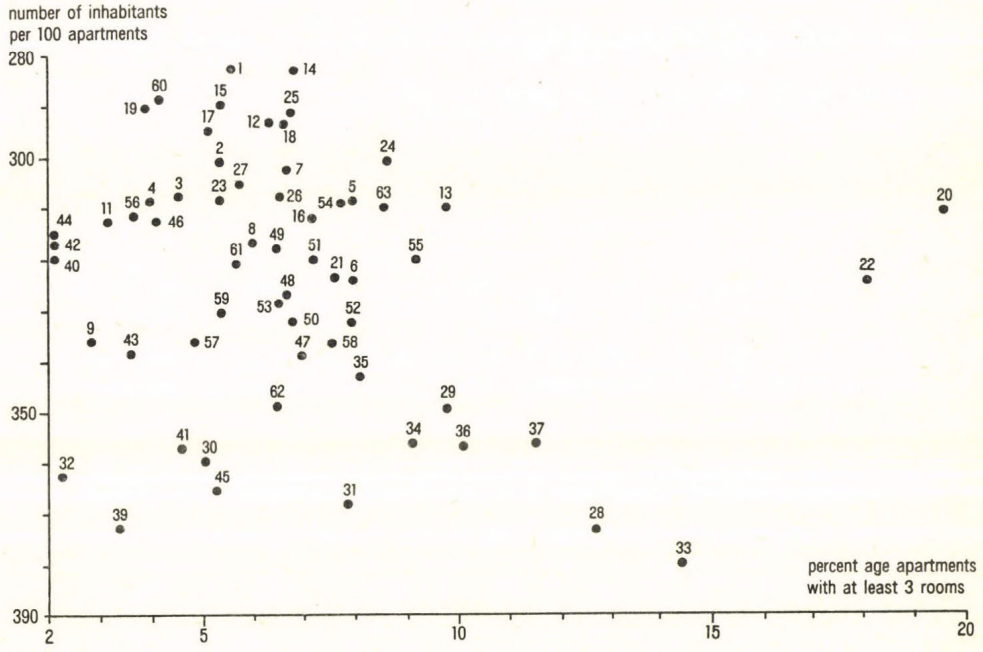

Fig. 5 Size of apartments and housing density in the small towns of the Great Hungarian Plain
(for number, cf. Fig. 2)

During the 70s the number of people per 100 dwellings decreased in all the small towns of the Great Plain: the highest figure (358) refers to Vásárosnamény and the lowest (256) to Battonya. At the same time, the ratio of dwellings with three or more bedrooms rose remarkably: the extreme values are 6.5 per cent (Nádudvar) and 42.1 per cent (Bácsalmás). This trend remained characteristic during the first years of the 80s, although the rate of housing developments decreased (DÖVÉNYI, Z. 1983).

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